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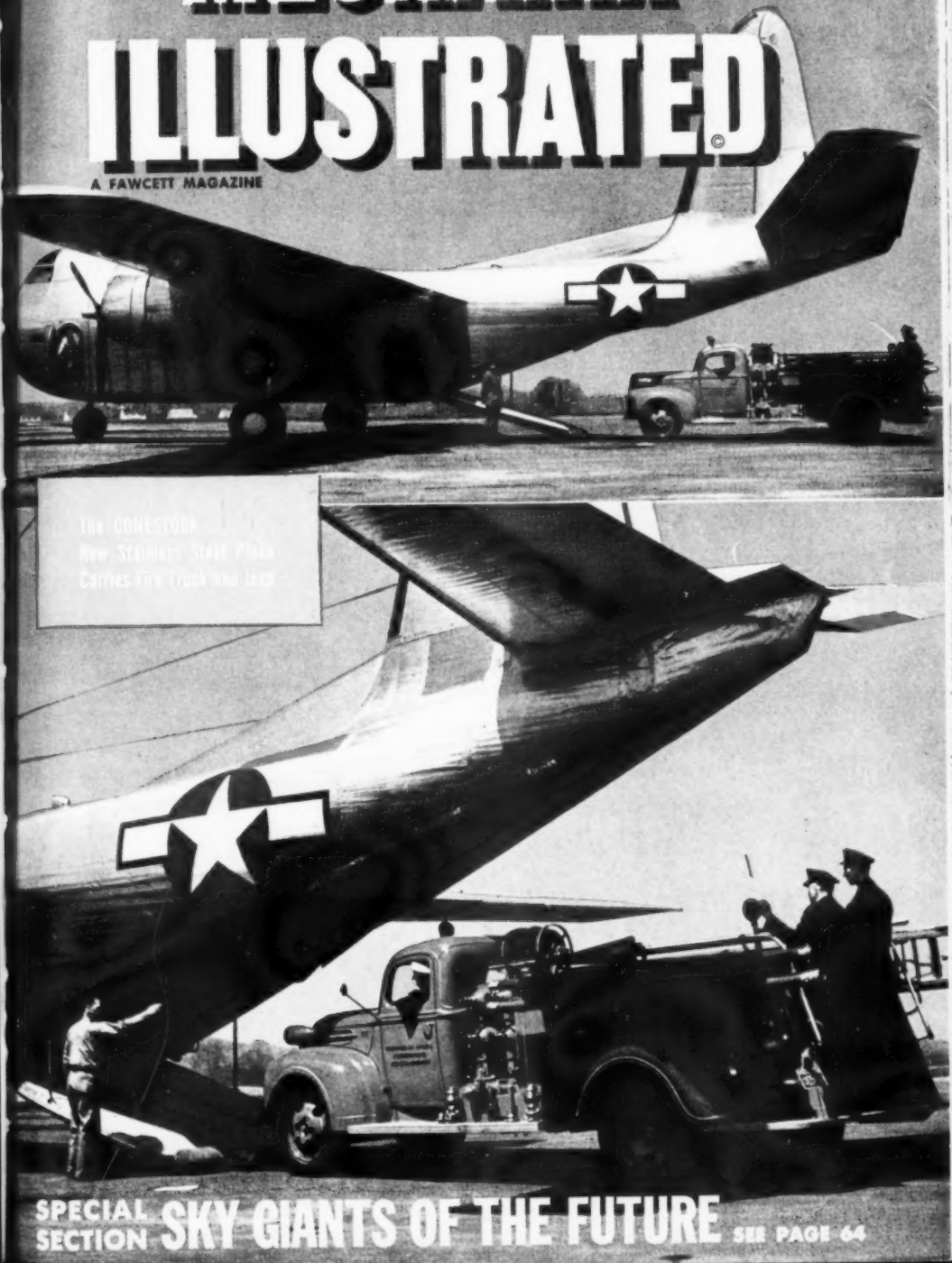

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SPECIAL FEATURES

THE GUNNERS HAD THE FUN—
by Richard Hanser 35
Below decks on the ship that sank the Scharnhorst

REVOLUTION IN WOOD 38

A HELICOPTER YOU CAN HANDLE—
by C. B. F. Macauley 39
Maybe this will be your post-war sky fliver

CHAIN LIFE SAVING 42

BOMBS VERSUS SHELLS—*by Willy Ley* 44
An expert describes the differences

CYCLES PREDICT THE FUTURE—
by Donald G. Cooley 47

CONTINENT OF TOMORROW—
by Henry Albert Phillips 50
No. 10: Brazil—biggest of them all

SCIENCE IN PICTURES—*Starting on* 53

WAVES TAKE OVER 63

WAGON WITH WINGS—*by John LaCerda* 64
Snub-nosed, stainless steel, flying box car

FLYING PULLMAN 66
Model 39, 48-passenger super airliner

TOMORROW'S AIR TRANSPORTS 67
Luxury air travel—illustrated in full color

DIVE BOMBER GUNNER—
by J. F. Swingle, ARM 72
Shooting down Japs from the back seat of a Dauntless

TACKLE FOR THE TROOPS—*by Louis Hochman* 77
Getting fishing rods and spinners to the boys at the fronts

BLACK AND WHITE MAKE COLOR—
by George Daniels 80

DEPARTMENTS

YOUR INVENTION CLINIC 14

CHIPS FROM THE EDITOR'S WORKBENCH 16

MONEY MAKERS AND MONEY SAVERS 26
(*Classified ads*)

CRAFTS AND HOBBIES

Starting on 83

MICROSCOPE WITH CAMERA ATTACHMENT 84
Built from pipe and scrap

PRINT YOUR OWN TARGETS 88

MULTI-VOLTAGE TRANSFORMER 90
for the home workshop

FUNCTIONAL FURNITURE 94

THE POTTERS ART, Part II— 98
Throwing and Turning

LAYOUT FOR MACHINING 102

DRESS UP YOUR WINDOWS 104

HOME AIDS 106

NOVEL NIGHT LIGHT 108

THE SCHOOL SHOP 109
Preflight aviation Lesson No. 18

LEAK-PROOF SKYLIGHT 115

U. S. ARMY DUCK 116
Wooden model of our amphibious truck

IDEAS FOR SERVICE MEN 118

HOUSE OF LATH 120

COPYING EASEL 121
Handy photo accessory

PHOTO CONTEST 122

PHOTO KINKS 123

EXPLORING A PHOTO SUBJECT 124

KEEP IT ROLLING! 128
Hints for your wartime car

CHIPPENDALE FRETS 130

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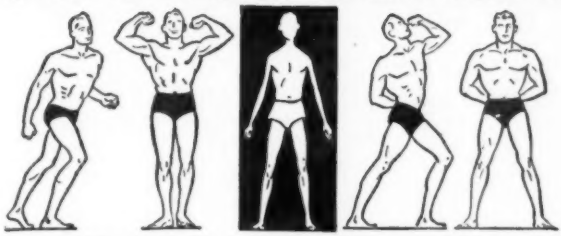

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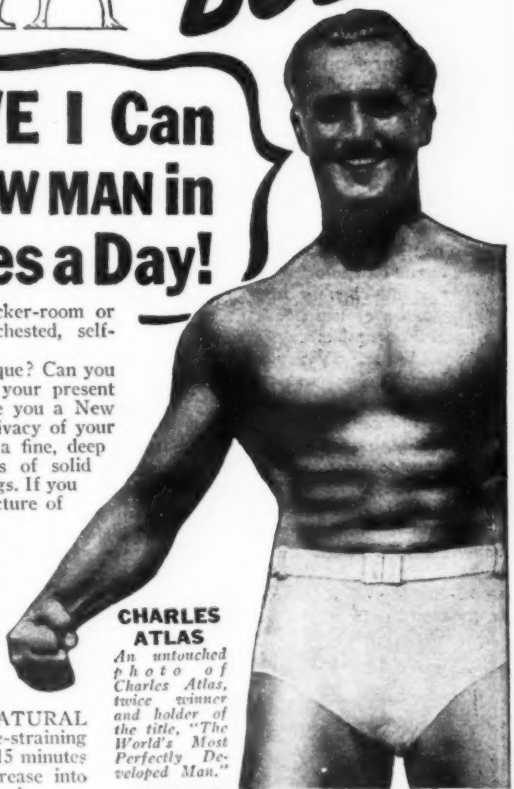

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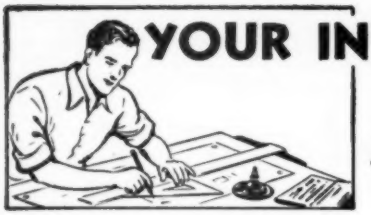

YOUR INVENTION CLINIC

Conducted by

JOSEPH H. KRAUS

Mr. Kraus has been giving advice to inventors for more than 20 years. He will attempt to answer as many letters from inventors as possible in his column each month. Mr. Kraus will "call his shots as he sees them" in this column. Thoroughly versed on inventions and inventions procedure, he will never, under any circumstances, disclose any valuable secrets. He cannot answer questions relating to patent law. For such information, the Editors suggest you communicate with any one of the patent attorneys who advertise in MECHANIX ILLUSTRATED.

Wood-turning Method

Gustav Burgeson of Youngstown, Ohio, sends a diagram of a wood-turning system and illustrates the tools used to expedite turning by the method he outlines.

ANSWER: *Templates have been used with regular wood-turning tools. In fact, automatic lathes have been designed and built which will turn wooden or machine parts directly from drawings. These are photo-electric devices and they follow every curve on the original plan.*

Your wood-turning tools, on the other hand, appear to be of use particularly for turning by your method and with the templates which you propose. We would recommend that you have a patent search made to determine whether or not you can get some protection on their design.

We do not see how you can possibly commercialize on your system. Any wood-turning shop could arrange a set of similar templates and then carry on the work exactly along the plan laid down by you. And you would never be the wiser.

It would seem that the only method for financial benefit would result from the sale of the specialized tool to be used with your method of wood-turning. On the whole, we think the plan is good and certainly worthy of investigation.

Trailer Heater

Julius Smith of Wilmington, California, sends a design for a trailer heater and wants suggestions for improvement.

ANSWER: *The heating arrangement outlined by you will work, of course, but it will not be quite as efficient as if you had a higher heater in the interior of the trailer. If you will substitute an ordinary automobile radiator for the small heater, you will get much better results.*

The heating tank on top of the kerosene burner should be a little deeper than you illustrate. A tank about a foot high will be excellent. In fact, instead of using a heating tank in this position, it would be much better to use a coil similar to those coils which you can find in the average gas water heater.

Make the connections as follows. Run a pipe from the top of the heating tank (or the top turn of the coil), to the bottom of the auto heater, and then bring the return from the top of the heater down to the bottom of the heating tank.

Near the top of the auto heater, you must arrange an expansion tank. A small T connection at this place, together with a small tank containing water, is all that is required. Now when the water expands on being heated, it will move into the expansion tank. The expansion tank also helps to keep the system full of water all the time, which is absolutely necessary if you expect this type of a unit to function.

Airplane Wheel Position Register

Cpl. Alfred G. Walters, Columbia, South Carolina, suggests the use of a ground contacting mechanism to actuate a register denoting when the wheels of a plane are in landing position.

ANSWER: *We do not see anything practical in your system for indicating if the wheels of a plane are down. There are hundreds of ways to show if these wheels are in the proper position without requiring a ground contacting mechanism.*

Such a mechanism is likely to prove dangerous, particularly if it strikes a small tree or rough ground. We advise against any action.

Fountain Pen Clip

Frank Godfrey of Rochester, New York, submits a design for a fountain pen clip, on which he wants our opinion.

ANSWER: *Judging by your description we believe that you have hit upon the design of a clip for fountain pens which is identical with the clip used on the Security pen made about fifteen years ago.*

We doubt very much that you can do anything with this idea. If there is some question in your mind, we would recommend that you have a patent search made.

Lacking Something Tangible

Joseph G. Hibbs, Jr., of Philadelphia, Pa., asks if we would recommend a patent application on

[*Continued on page* 146]

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Chips from the Editor's Workbench

Calling All Contestants!

The thousands of dictionary-thumbers who piled into MI's $5,000 Word Game Contest are probably awaiting the results with bated breath and bankbook poised. Here's good news for you—we'll be able to get the final results tabulated in time for our September issue. The editors are already knee-deep in entries, scanning hundreds of them every day in search of the perfect score. Thus far we've found a lot of over-eager contestants who made the sad mistake of summing up their scores on the basis of *word value* instead of *letter value*—that is, they counted the same letter twice when it appeared in both a vertical word and a horizontal word. Others seem to have been straining at the contest rules pretty hard in their concepts of just what constitutes a word. There's plenty of ingenuity showing up in this year's battle, though, and the contest promises to be a lively one. Get your September MI early and see if you're on the prizewinning list!

First Heli Book

C. B. F. Macauley, author of this month's article on the Bell helicopter wasn't always an aviation journalist, but he's had the flying bug for as long as he can remember. When he was 17 he couldn't get in the Air Corps so he did the next best thing—serving a hitch with cavalry down Texas way. Despite defective vision, which kept him from becoming a pilot when he transferred to the Air Corps in 1929, he managed to get in a lot of flying time off the record. For several years after leaving the Army he worked for newspapers and wire services, serving a four-year stretch as Washington correspondent. Now, after editing several aviation journals, including the Civil Aeronautics Journal, Aviation Air Tech and Pegasus (house organ of the Fairchild Corp.) he has turned to free-lancing. His book on helicopters, "The Helicopters Are Coming," the first complete work devoted to that subject, was published recently. In addition to becoming the country's foremost authority on tomorrow's flying jalopies, Mr. Macauley manages to find time for a wide variety of hobbies, including Leica photography, folk music, decorating and designing, and playing the Spanish guitar.

Tip for Technicians

A recent poll conducted among college placement officials on the vital question of postwar opportunities for engineers and technicians yielded some interesting results. Of 54 engineering and technological schools covered in the survey, officials of 38 were definitely optimistic about the peacetime demand for trained scientists, while the others felt that supply would equal or surpass demand or that the picture might be too complicated by economic factors to allow any prediction.

The clear concensus of opinion was that an adequately trained engineer or technical worker will have no trouble getting placed after the war, in view of "the vast amount of construction work which must be done to rehabilitate the countries now torn by the implements of war." Then, too,

[*Continued on page* 156]

MODERN WONDER CAR

Melvin Bagwell, 18 Main St., Arkwright Mill, Spartanburg, S. C., sent us this photo of what is really something of a super-car. It has no tires, requires no gas, and can attain practically any speed—when pushed hard enough. The driver is protected from sun and rain by the umbrella. "The gas and tire problem is solved," writes Mr. Bagwell. This unusual solution of transportation difficulties nets Mr. Bagwell a $5.00 Workbench award and a Certificate of Merit.

At 7:30 p.m., last December 26, Hitler's crack Scharnhorst was a "marvellous target with her armor plates glowing red hot and flames leaping through her superstructure aft of the bridge."

THE GUNNERS HAD THE FUN

by Richard Hanser

The gunners had ringside seats, but the "men below"—the grease monkeys on the cocky Norfolk—didn't know what hit them until the show was over

LONDON—When the battered but extremely cocky cruiser Norfolk pulled into this British port for repairs, every man-jack aboard had a tingling tale to tell about the spectacular rumpus off the North Cape which resulted in the sinking of the Scharnhorst in one of the classic naval engagements of the war. His Majesty's Ship Norfolk had been through a whale of a fight, and the traditional (and largely mythical) British reticence didn't prevent the crew members from unlimbering their vocabularies and letting fly with vivid descriptions of what a jolly good go it was, sending one of Jerry's most beautiful battleships to the bottom.

A somewhat jarring note was struck by a morose rating whose version of the battle was rather more abrupt than that of his shipmates. "It was the same old story," he said. "We did all the work, and the gunners had the fun."

From this remark it was simple to deduce that the rating in question was a member of the engine crew—one of the boys who, come the worst kind of hell and the highest kind of water, do their stuff down in the bowels of the ship and never have the thrill of sending a salvo on its way to the spot where it will hurt the enemy the most.

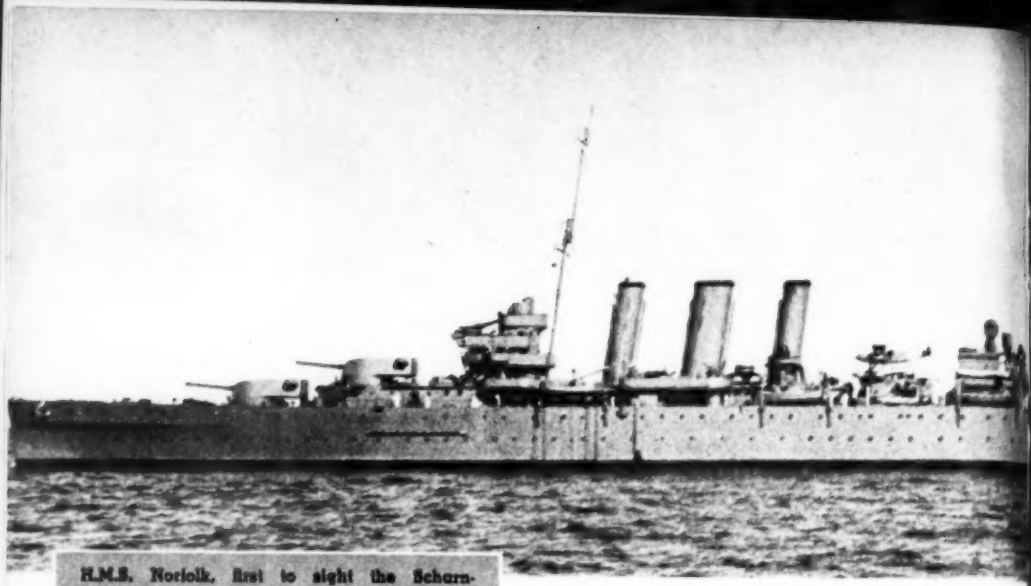
The engine crew doesn't get to see the kind of heart-pounding spectacle that the Norfolk's commander, Capt. D. K. Bain, described as the climax of the battle when the doom of the Nazi sea mammoth was written large in the dark arctic skies:

"Our last glimpse of her came when she was almost on her beam ends, firing with everything she had left. She was a marvellous target with her armor plates glowing red hot and the flames leaping all through her superstructure aft of the bridge. . . ."

No, the oil-soaked seamen in the engine room don't get to see that kind of thing; what they are privileged to feast their eyes on during the heat of the fray is a conglomeration of gauges, dials and indicators which let them know whether they are keeping the engine battle-fit and up to its job of driving the ship in the only direction that interests the Royal Navy—toward the enemy.

The part played by the Norfolk in the Scharnhorst melee was a magnificent demon-

FRED RIFFERD



H.M.S. Norfolk, first to sight the Scharnhorst, first to open fire and score a hit, and first to be hit in the historic fight.

stration of how the "men below" can spell the difference between a successful action and a fiasco, regardless of what is going on above where the gunners are having all the fun. When you hear the men of the Norfolk's engine room telling their stories in their matter-of-fact way, you get a glimmering of what is involved in the business of sweating it out below decks during a major sea engagement amid smoke, flame, skull-splitting noise and uncertainty as to just what the hell is happening upstairs.

The Norfolk, of course, doesn't claim to have done in the Scharnhorst all by herself. The Duke of York had something to do with it, and so did a few destroyers and other craft. But the Norfolk was in the battle from the very first moment until the very last moment, and the Scharnhorst owed a considerable portion of the woe that befell her to Capt. Bain's doughty warship. Specifically, the Norfolk was the first to sight the Scharnhorst; the first to open fire on her; the first to hit her; and she was the first British ship to be hit. It was due to salvos from the Norfolk that the Scharnhorst turned away the first time. "We got a couple of shots into her somewhere near the bridge," says Capt. Bain. "That shook her gunnery, and she went away." The Norfolk went right after her.

"The next time the cruisers found her," Capt. Bain continues, "we went hell for leather for her and fired again. I like to think that we hit her again, and I believe we did.

"We were hit with a couple of 11-inch shells. One raised a pretty good fire by igniting some oil. The other caused some casualties.

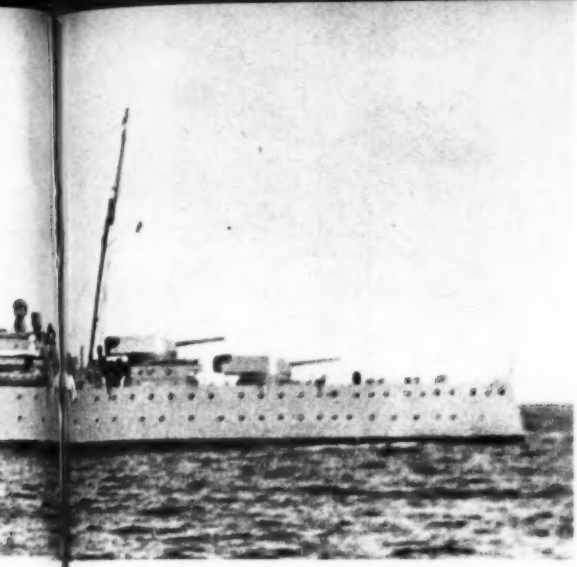
"We were chasing the Scharnhorst with all we had. Our ship produced more knots than she had ever done before. The engines were going all out, and in the middle of this, with a frightful noise going on down below, we got this fire and stuff."

That is a sketchy over-all picture of what occurred topside on the Norfolk during the fight. The key phrases in the captain's story, as far as the men below were concerned, are these: "a pretty good fire" and, more important, "the ship produced more knots than she had ever done before."

The story of the "pretty good" fire and the knots is best told by Chief Engine-room Artificer Cardey, who is 26 and comes from Cornwall. He tells it this way:

"The captain broadcast over the ship's loud-speakers that we were going into action. I was in the foreward engine compartment and as we pushed up the speed, the hiss of the steam going through the pipes and the noise of the gears made it impossible to hear anything further from the loud-speaker. We knew we had gone into action because of the dull crash and the vibration of the guns firing.

"I was standing in the middle of the compartment by the dials when there was a vivid flash and bits of metal rained down. One hit an engine-room rating, who was standing next to me, in the leg." Cardey points to a jagged gap in the steel floor of the engine



room through which the piece of metal went after wounding the rating.

"Another piece tore off the tops of two fingers of a man who had his hand on a lever," Cardey continues. "He didn't know he'd been hit until fifteen minutes afterwards. Water began to pour down through the engine-room hatches. Fuel oil came along with it, and I saw one fellow looking like a polished ebony statue. He'd been covered from head to toe with thick black oil. He went about his business as if nothing had happened.

"I went across to the dials and found that the pressure was not affected. Some of the lights had gone out and there was a good deal of smoke. We knew by the smell that there was a hell of a fire going somewhere.

"Everybody was too busy to come and tell us what had happened. Every man in the engine-room had his work to do, so we carried on and only heard odd bits and pieces of information when they brought us down sandwiches and so on. We kept the engines going at full speed for six hours after the Norfolk was hit. There was about three feet of water swishing about in the bilges below the engine-room, and the lower footplates were covered."

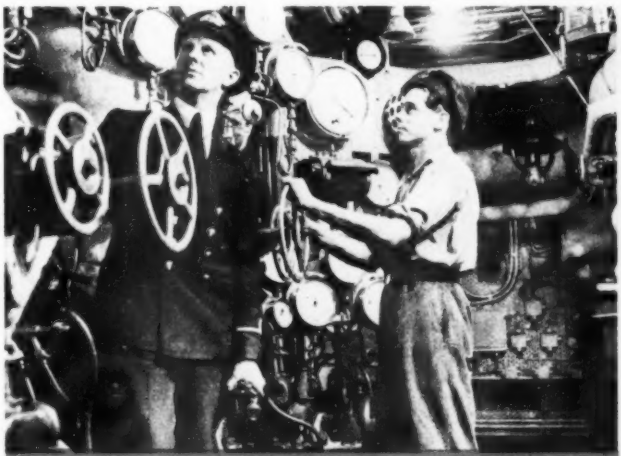
Another description of what it was like down below when the Nazi battleship was being prepared for her last rites comes from Chief Engine-room Artificer Davies, a veteran R.N. man from Newport. He says:

"When the Scharnhorst's shell tore in through the side of the ship and ripped up the deck just above the engine-rom like cardboard, we could feel the blast all across the engine-room. There was a vivid green flash and a thick pall of smoke from one corner of the engine-room, then a strong smell of burning. But we had 80,000 h.p. to control, and we had no time to think of anything else. Our ears were keyed for any strange noise in the engines which might give us the first indication of trouble."

The buzz went around the engine-room that the Norfolk had been hit by an 11-incher, but it wasn't until the battle was all over and the Scharnhorst a corpse that the men below got to know what hit them.

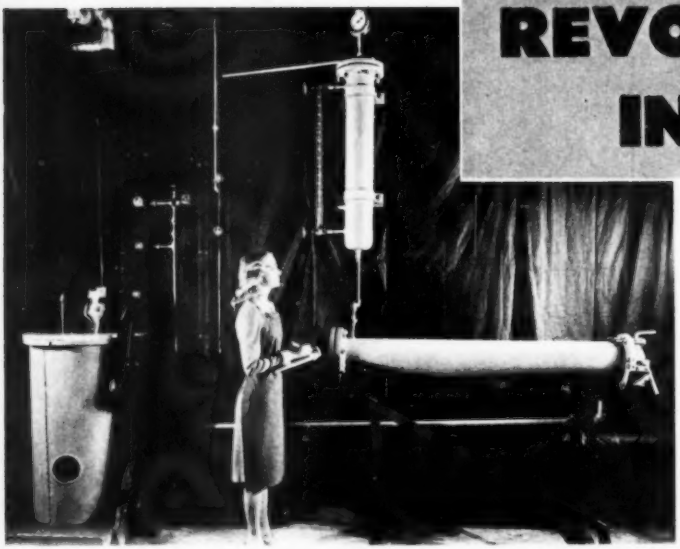
Meanwhile, squads of seamen were working feverishly to put out the fire and the Norfolk kept plunging ahead in the wake of the fleeing Scharnhorst. Holes had to be cut into the deck in an attempt to get at the flames. Three times the fire-fighters appealed to Capt. Bain to ease up on speed and give them a chance at the flames unhampered by the rolling of the ship. Each time Capt. Bain replied, "I'm not slowing up. We've got the Scharnhorst in the bag and we're keeping after her."

And so the chase [*Continued on page* 148]



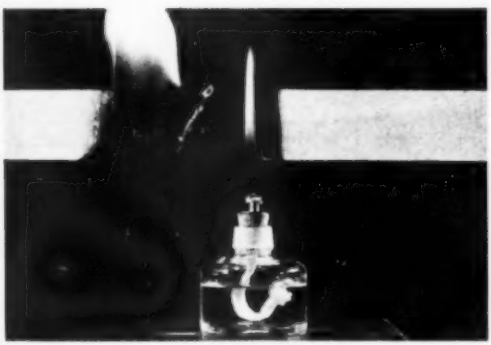
In the heat of battle the "downstairs boys" never see anything but a conglomeration of gauges, dials and indicators.

REVOLUTION IN WOOD



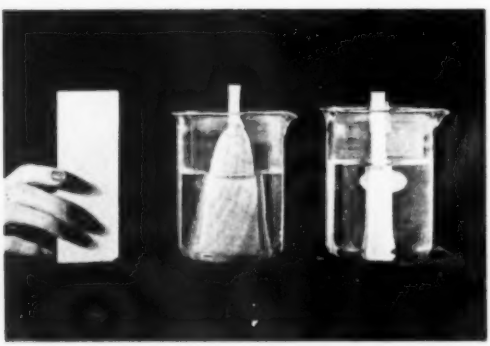
In this experimental treating unit, wood placed in cylinder, right, is impregnated throughout its structure with methylolurea from tank at left.

WITH the aid of miracle-working methylolurea, a chemical derived from coal, air and water, the du Pont Company has developed a means of rendering the softest wood harder than ebony. Lumber thus treated is really a new material with great compressive strength, resistance to moisture, stiffness and non-inflammability. Sawdust, shavings, paper, leather, may be treated.



Untreated piece of wood, left, catches fire from alcohol lamp; treated board is only charred by flame.

The upper strip of wood, treated with du Pont's new chemical, is bent less by weight than untreated one.



When compressed balsa blocks are placed in water, untreated one (center) quickly regains former size.

Spindles, bobbins, spools and other textile gadgets, once made of steel, can now be fashioned from wood.

A HELICOPTER YOU CAN HANDLE

Bell's new helicopter is a two-place cabin craft with a two-bladed rotor and an anti-torque tail propeller.

by C. B. F. Macauley

Director of Aeronautical Research, Dohner & Lippincott

Arthur Young fooled around with model helicopters for 15 years. One of his toys may be your postwar flivver.

THE newest helicopter to be unveiled to the American public is Bell Aircraft Corporation's sleek two-place design. I had the privilege of being the first technical writer to be shown the remarkable developments which have been accomplished in the Gardenville helicopter laboratory, near Buffalo, N. Y.

Like most outstanding achievements, this is the story of a man and a purpose. The man is Arthur Middleton Young, designer of the craft. He has been working steadily and persistently at the problems of helicopter flight for 15 years. To his experience there was added a few years ago the vision and resourcefulness of Larry Bell, one of the world's outstanding producers of fighter planes.

The extent to which Young is wrapped up in his idea is exemplified by the following incident. At a dinner in a little Italian restaurant in Buffalo, with Young, his charming wife, Priscilla, and a few friends, we were suddenly startled by a miniature helicopter whirling gayly down to the center of the table. Arthur had fashioned it from a piece of the menu and a paper clip.

Priscilla Young was not very surprised, however. She explained that the whole affair was so overwhelming she hadn't any capacity for surprise left. It seems that after graduation and marriage, Arthur Young didn't go to work every day or pursue a career or profession like most men. He flatly announced that he was inventing a practical helicopter.

The Youngs lived on a farm at Paoli, Pa., not far from Philadelphia. He had a fairly elaborate workshop in the barn and on good days he'd chase the cows from a corner of the pasture and fly model helicopters. Priscilla admits that she and some of their friends thought at times it was rather an odd way for a grown man to act—playing with toy flying machines day after day, year in and year out—

Helicopter on the left is the new Bell Aircraft model; on the right our artist has pictured an older type. Because of a stabilizing bar, which acts as an artificial horizon, the rotor on Bell's ship tends to remain horizontal—it doesn't tip no matter how much the cabin is buffeted by gusts of wind.

but evidently he could afford it and he had an engaging personality so they guessed it was all right if that was all he wanted to accomplish in life.

Young wasn't playing, though. He avoided some of the costly mistakes which have plagued his predecessors and contemporaries. He did not risk effort or money in building a full-scale model until he was confident he had most of the answers. He had tiny rotor blades made by the hundreds; whenever a model met with disaster, he simply fastened on a new set of blades and continued his experiments. Finally, he discovered a means of achieving stability. This made possible the extensive flying of scale models by remote control. By twisting a couple of knobs corresponding to flight and power controls he caused his models to take off, ascend, descend, fly horizontally, reverse direction and land.

A few years ago Bell learned of Young's accomplishments. Laurence D. Bell has been in the aviation business for a long time and has a reputation for being a bold innovator in aircraft design and production techniques. So, while the rest of the industry was for the most part pooh-poohing the possibilities of the helicopter for decades to come, he quietly provided Young with the necessary facilities and, in effect, told him to "deliver the goods."

Young, born in Paris November 3, 1905, is the son of Charles Morris Young and the former Eliza Middleton Coxe, both American artists of distinction. He is the only one in the family with a mechanically inventive mind. He is not the secretive or "lone-wolf" type of inventor. As a matter of fact, he shares credit for the present accomplishment with Bartram Kelly, friend and associate of long years' standing who is now with him at Bell Aircraft.

The working relationship between the two men is interesting. Young throws out an idea for some improvement or new device. Kelly will figure for hours, sometimes days, working the proposition out mathematically in an effort to predict its chances for success.

Frequently Kelly reports, "No, it won't work." Occasionally, Young persists in a practical test of his idea anyway. If he fails, Kelly enjoys a huge laugh. But if, as sometimes happens, Young's experiment proves successful in spite of a negative mathematical prediction, he gleefully rips Kelly for days.

The first full-scale machine was completed early in 1943. It and later models have been undergoing flight tests steadily ever since. They are two-place types with pilot and passenger sitting side-by-side. Like several other designs now flying, it has a big main rotor atop the cabin and a small auxiliary rotor at the end of a long, slender tail.

Unlike most others, however, the main rotor has two blades instead of three. The blades are long, narrow and rigid. But, more important, the rotor's position in space is governed, not by the position of the mast to which it is attached, but by a stabilizing bar coupled to it which acts as an artificial horizon. The cabin is suspended beneath the rotor much like a plumb bob.

In other words, the revolving rotor tends to remain horizontal and does not tip if the cabin of the machine encounters gusts of wind. This increases the stability of the craft and makes for greater ease of control.

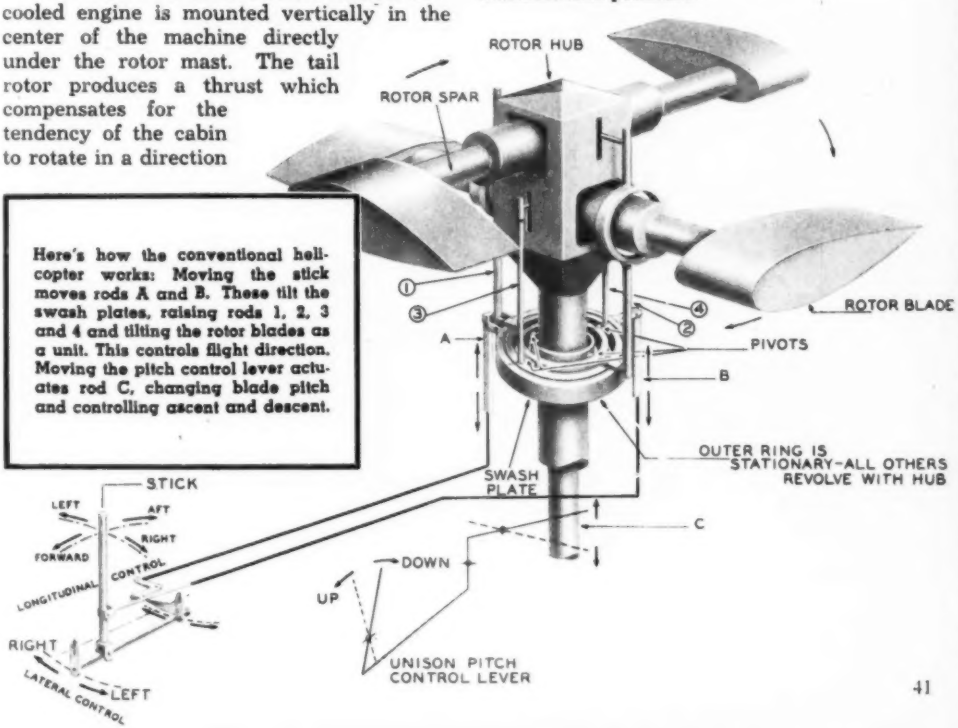
In current models a small Franklin air-cooled engine is mounted vertically in the center of the machine directly under the rotor mast. The tail rotor produces a thrust which compensates for the tendency of the cabin to rotate in a direction opposite to the rotation of the blades due to the tongue.

The interior of the cabin, with its controls and instruments, is relatively simple. There are just two controls, a stick between the pilot's legs which governs the direction of flight, and a lever to the left of the instrument panel. The lever is raised to ascend, lowered to descend. Moving it to the right or left alters the pitch of the tail rotor so the direction in which the cabin points will coincide with the horizontal direction, or flight path, of the main rotor. Engine power is regulated by twisting the hand-grip on top of the stick.

Now for the $64 question—When can I buy one?

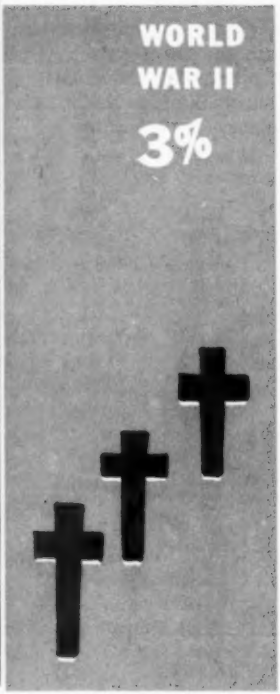
The Bell helicopters, at their present stage of development, are not ready to go into production for sales to the public. They are being developed now for their expected military value. After the end of the war, further engineering refinement will be necessary before the helicopters go into production for commercial and private purposes.

However, it isn't over optimistic to predict that it will not b emore than a very few years until the helicopters have reached that stage of practicality an dsafety which will enable thousands of us to own and enjoy them for business and pleasure.



Here's how the conventional helicopter works: Moving the stick moves rods A and B. These tilt the swash plates, raising rods 1, 2, 3 and 4 and tilting the rotor blades as a unit. This controls flight direction. Moving the pitch control lever actuates rod C, changing blade pitch and controlling ascent and descent.

300-800 YDS
½-1½ MI.
4-8 MI.
1. COMPANY AID MEN
These are the medical soldiers assigned to serve with fighting troops. Reaching the wounded within minutes, often seconds, they give expert emergency treatment, ease pain with morphine, administer sulfa and then tag the casualty for future care.
2. BATTALION AID STATIONS
Litter-bearers rush wounded to these "hospitals" which move to new positions each time fighters advance. Here, medical officers perform emergency surgery, give blood plasma to safeguard men until they can reach fully equipped installations farther back.
3. COLLECTING STATIONS
Close to the zone of battle, these stations care for both walking and transported wounded. They maintain contact with all division battalion aid stations. Here, wounded men are prepared for transportation to more permanent Medical Department units.



AVERAGE DEATH RATE FOR 100 WOUNDED MEN

Today the soldier gives his own wounds immediate treatment. Superior medical care takes over then. Most seriously wounded men are attended to first.

COMPARABLE DEATHS FROM DISEASE IN WARS

In World War I more men died of disease than were killed in action. Today the death rate from disease is 1/20 as high. Malaria is worst enemy.

4. CLEARING STATIONS
These are well-equipped but temporary installations serving one division and beyond the immediate fighting area. They have complete surgical equipment, electricity, full kitchen facilities. Triage, the sifting and classifying of patients, is the main function.
5. EVACUATION HOSPITALS
Set up as near the front as practicable, they provide facilities for major medical and surgical treatment of all casualties. From here, evacuees are moved to hospitals in the rear. The recovered wounded return to the front.
8. CONVALESCENT HOSPITALS
Used where no further treatment is necessary. Accept patients from evacuation hospitals who will be fit for full field duty within a reasonably short period of time. The Red Cross and other civilian groups function here.
30 - 100 MI.
WITHIN COMBAT ZONE
WITHIN THEATRE OF OPERATIONS
WITHIN COMBAT ZONE
6. STATION HOSPITALS
Fixed installations providing general medical and surgical treatment in an area of military population insufficient to warrant a general hospital. They are established in camps in the U.S.A. as well as in the zones of combat.
7. SURGICAL HOSPITALS
Fixed units with independent mobile divisions designed primarily to furnish facilities for major surgical work near the front for a limited number of cases. These mobile units help to relieve division clearing stations of non-transportable casualties.
9. GENERAL HOSPITALS
Situated in continental U.S.A., these are large, fully equipped installations staffed with experts in every field of medicine, surgery, and psychotherapy. Among better known general hospitals are Halloran on Staten Island, Walter Reed in Washington, D.C.

WAR ADVERTISING COUNCIL, INC.

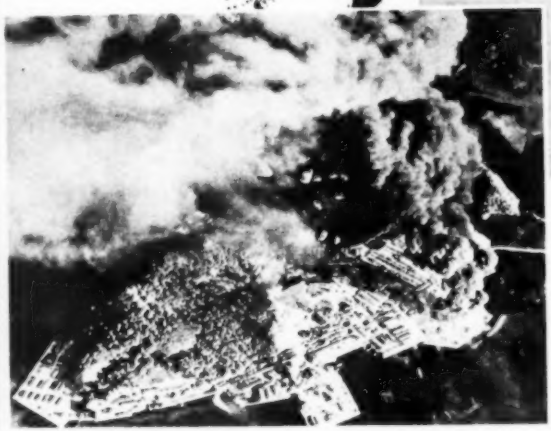
CHAIN LIFE SAVING

NO MATTER where the Yank fighting man goes in this global war, the Army Medical Department is at his side. With its marvelous system of chain life saving from the stretcher bearers on the battlefield to the security of the general hospitals far from the front, the A.M.D. has piled up a record of soldier saving that is without a doubt the greatest achievement of our war effort. Dubbed the "pill roller," the medical soldier carries no gun, kills no foe. His is the unspectacular job of unending, dangerous work.

BOMBS vs. SHELLS

by Willy Ley

MI's expert gives you the lowdown on air bombardment as against artillery fire.



Above, Flying Forts let their bomb loads fly over an enemy target. Left, what remained of a Jap base in the Carolines after air attack.

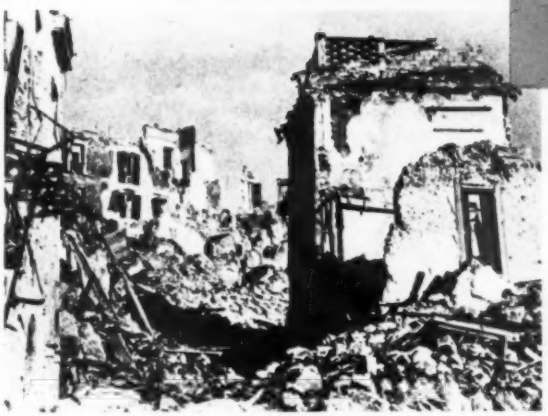
PROOF that the Russians and their western Allies do not act in full agreement, according to a recent European underground joke, is this: The British and the Americans are busy bombing Hitler to death, but the Russians prefer heavy artillery.

But now that the invasion has started that joke sounds much less funny. In the invasion the Americans are displaying a marked ability with 155 mm. "Long Toms" and 240 mm. howitzers. Just the same, the question hinted at in that little story, the question whether bombs or shells are more destructive, is still important. That question has been asked thousands of times and is still a bone of contention among armchair strategists as well as among professional officers.

The difference is that armchair strategists are apt to ask simply whether bombs or shells are preferable, while professional officers ask whether bombs or shells should be used *in a specific action.*

In that latter form the question makes sense

The British 4.5 gun above has been pounding Germans from Africa to Italy. Left, town of Pontecorvo after such treatment.



and the proper answer, which may differ from case to case, might well decide the outcome of that action. In its general form that question cannot be asked at all: it is what philosophers call "sense-free," for the simple reason that bombs and shells cannot be compared with each other.

At first glance that statement may be doubted. On the surface there seems to be mainly a difference in external shape; otherwise bombs and shells are both metal containers for high explosive, equipped with a fuze to set off the charge at the proper instant. It seems that the external shape differs only because the methods of transportation are different. It seems as if there were no reason why the action on or in the target should differ.

Well, let's approach the problem in a systematic manner.

A bomb consists essentially of three parts. One is the body, usually cast in mass production and provided with fins at one end to make it drop nose first. This is not to insure proper functioning; it is a question of aiming. The larger types of British blockbusters look like small tank cars minus wheels, without fins. They tumble end over end through the air when dropped, and what they lack in accuracy they make up in destructive power. (At this point we get into the first controversy about bombing, the one of area bombing versus precision bombing, but we'll skip that problem.)

The second important part of every bomb is the high-explosive charge, usually TNT. This is really *the* important part, for the whole air raid is undertaken solely for the purpose of carrying that charge to the enemy. The term "high explosive" is not just a figure of speech to impress the reader; it has a definite meaning. There are also "low explosives," even though they are not called that as a rule.

The first of all explosives, ordinary gunpowder, was such a "low explosive." It consists, as everybody knows, of saltpeter, sulphur and charcoal. When ignited the sulphur and the charcoal are "fuel," while the saltpeter gives off the oxygen required. The combustion produces large quantities of expand-

SHELLS

Type		Weight (in lbs.)	Weight of HE (in lbs.) 10%	15%	Maximum range in yards (approx.)
75 mm.	Army	14	1.4	2.1	14,000
90 mm.	Army	26	2.6	3.9	16,000
105 mm.	Army	33	3.3	4.95	18,000
155 mm.	Army	95	9.5	14.25	26,000
240 mm.	Army	345	34.5	51.75	18,700 (How.)
6-inch	Naval & Seacoast	108	10.8	16.2	.....
8-inch	Naval & Seacoast	320	32.0	48.0	.....
10-inch	Naval & Seacoast	617	61.7	92.6	.....
12-inch	Naval & Seacoast	900	90.0	135.0	.....
14-inch	Naval & Seacoast	1200	120.0	180.0	42,000
16-inch	Naval & Seacoast	2340	234.0	351.0	55,000
20 mm.	Airplane Cannon	4.5 ozs.	.....	.....	
37 mm.	Airplane Cannon	1.1 lbs.	.....	.....	

The main types of artillery shells used in field artillery, naval and coastal guns are listed above. In addition to those mentioned, there are solid shot for 37 mm. and 75 mm. anti-tank guns; armor-piercing ammunition for big rifles; gas, smoke, incendiary shells.

BOMBS

Weight (in lbs.)		Weight of HE (in lbs.)	
100	(U. S.)	55	Demolition Bombs
250	(U. S.)	120	Demolition Bombs
500	(U. S.)	260	Demolition Bombs
1,000	(U. S.)	550	Demolition Bombs
2,000	(U. S.)	1,050	Demolition Bombs
4,000	(Brit.)	2,100	Blockbusters
8,000	(Brit.)	4,500	Blockbusters
12,000	(Brit.)	7,000	Blockbusters

Fragmentation (anti-personnel) bomb: 24 lbs. (German), with 4 lbs. HE charge.

Incendiary bombs: From 2 to about 75 lbs; thermite in smaller, solidified oil in larger types.

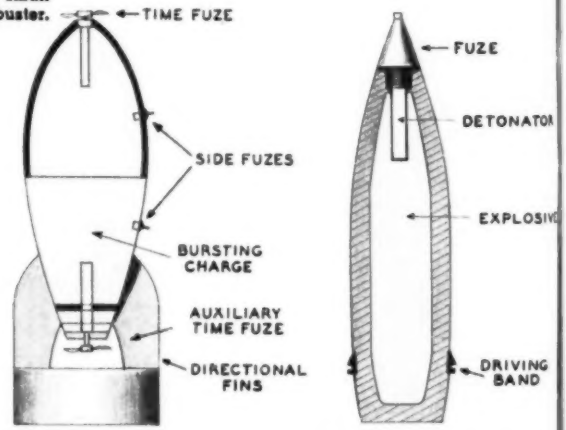
And here's the list of bombs, ranging from the small demolition type to the newest 12,000-lb. blockbuster.

ing hot gases. This fast generation of gases accounts for the destructive power. The high explosives, first of which was guncotton, function in a different manner. When set off they do not really "burn" in the sense that gasoline or even gunpowder burns. Instead, they are suddenly disrupted into gases. One chemist expressed it once by saying that high explosives are really gases which have been tricked into solid form and which return to their "true" state in virtually no time.

An instructor who lectured to German cadets some thirty years ago used to demonstrate the difference to his pupils by taking them outdoors and piling half a pound of gunpowder on a slab of slate. When the gunpowder was exploded it discolored the slab, but that was all. Then he took a much smaller quantity of a military high explosive and placed it on top of the slab, where the gunpowder had been. The explosion shattered the slab—the HE converted itself into gas so fast that the air had no time to get out of the way, so that the force of the explosion acted in all directions, even downwards.

Needless to say, substances so powerful have to be safe so that they can be used; in fact, safety is more important than destructiveness. This is the main reason why guncotton is no longer in use—it is not quite safe enough. TNT is safe, and so is Explosive D (the latter is even safer than TNT and won't go off even when smashing through armor plate if the fuze fails to function) and for this reason TNT is the most used of all high explosives, especially since it can be manufactured in almost unlimited quantities at a low price.

Now if modern HE is so safe that it can be shot through armor plate or dropped from 20,000 feet without exploding, one might well ask what *will* cause it to explode. The answer is: another explosion. And to furnish that other explosion at precisely the right instant is the job of the third essential part: the fuze. A fuze, as a rule, consists of a firing pin which is pushed into a percussion cap filled with fulminate of mercury or a similar very unsafe substance which can [*Continued on page* 149]



DEMOLITION BOMB — HIGH EXPLOSIVE SHELL

CYCLES PREDICT THE FUTURE

by Donald G. Cooley

What'll it be in 1970—grand opera or pratfalls, bustles or flapper skirts? With cycles, you can forecast tomorrow's culture.

WILL women's skirts get shorter before they get longer? Will the bustle ever come back? Will your children prefer dime novels or works on metaphysics? Will hepcats throw out jive in favor of symphonies? Will people again live in houses with gingerbread trim and iron deer on the lawn? Will they prefer burlesque to tragic plays full of wrinkled thought? Will they "get religion" in new forms or drift farther from the church? Will they think that paintings made up of cubes, circles and triangles are "just darling," or prefer something they can recognize?

Matters like these come under the head of culture patterns. Culture, like the stock market, the tides, the weather and the emotions, has its rhythmic pulsations, its pendulum-like swings. By measuring culture cycles of the past, we can predict within reasonable limits when such patterns are likely to recur in the future. Closely enough, at least, to disturb or inspire us.

Take the matter of woman's dress. Skirts in the flapper era were sold pretty short. Eventually they lengthened out again. This cycle was short enough to be remembered by most adults. It is mentioned as rather obvious proof that styles do change and that when they change they do not have entire freedom of direction: they must move away from the present, even reverse themselves and eventually repeat, thus exhibiting the characteristics of a cycle. Clearly, when a skirt reaches what may be termed its optimum elevation, the only direction in which it may proceed with circumspection is downward.

But cycles in fashion, as in other aspects of culture, go much deeper. Agnes Brooks Young has demonstrated that through the centuries, women's costumes must be one of three basic forms: the tight or cylindrical, the full or bell-shaped, and the off-center (which includes the bustle). In the U. S., these three types have regularly followed one another for two centuries.

"When a skirt reaches optimum elevation, the only direction in which it may proceed with circumspection is downward." Ankles won't be showing soon.

Each type has a life cycle of about 35 years. The hobble skirt was an example of the tight or tubular era, well if not flatteringly remembered. We are shortly due to swing into a peak period of bell-shaped dresses. The girls

The bustle's due for a comeback in the 1970's, but it may sprout "ledges, mounds and declivities." As for men, they'll take to ruffles, riotous colors.

will go in more for yardage than shortage. This may well coincide with the end of the war, when uniformed women revert to the feminine, and the cycle will probably take up the slacks discarded by fashion-conscious females.

And, along in the 1970's, we may look for a comeback of the bustle. To be sure, the new bustle may not be identical with the gluteal excrescences embalmed in family tintypes. New varieties of anatomical padding may be devised to give the figure an off-center aspect, asprout with ledges, mounds, and declivities that will no doubt strike the beholder as attractive, culture cycles being what they are.

Fashion cycles have obvious optical impact, but other culture patterns are more important. The most impressive predictions of tomorrow's culture must undoubtedly be based upon the immensely detailed cycle studies of Dr. Raymond H. Wheeler of the University of Kansas. As previously reported in MECHANIX ILLUSTRATED, Dr. Wheeler has gathered tens of thousands of items of historical fact, arranged them chronologically through tens of centuries, and demonstrated unmistakably that cycles repeat themselves irresistibly in all human phenomena, like a continuous and regular pulsebeat throughout history.

These cycles, in their cultural aspect, divide into two great types: "warm culture" and "cold culture," corresponding to prevailing conditions of world climate. We are just crossing over into a long "cold culture" period in which most of us may expect to live out the rest of our lives. Except for a warm period around 1950-1955, and later short recessions predicted on a basis of climatic cycles, the rest of our century should be prevailingly cold. Indeed, one of the major cold droughts of history is anticipated toward the end of the century when cycles of 90, 170, 510, and 1020 years are all due to converge.

What, then, will the world be like during the "cold culture" that is looming? It should be a world of gaiety and humor, plenty of color, more than a little vulgar, simple and sentimental and sympathetic. It will be a democratic world, with cultural standards set by a middle class rather than a wealthy aristocracy. Culture will be superficial and shallow rather than profound and idealistic. The individual will be more important—the part more important than the whole, as Dr. Wheeler explains the cold culture, so that greater individual freedom and less regulation by government is to be expected.

In such a world, you may literally expect to be a more colorful person. Riotous colors, garish plaids and large splashy figures will be typical in costumes. The bustle and similar contraptions may be expected to accompany a passion for flares and folds in dress. Lace, fancy buttons, lacings, and all manner of ornamental gadgetry will reflect a tendency to elaborate decoration. The swing will be back to the Victorian and Elizabethan, and if men refuse to wear those ruffled Sir Walter Raleigh collars they may be expected to turn thumbs down on blue serge and oxford gray. Your son may cut a dashing, swashbuckling figure that would have routed you to an institution.

Similar tendencies in art mean lean pickings for abstract painters of the Four-Oysters-In-Search-of-a-Cubist variety. The curtain falls on surrealism and impressionism; cold culture paintings are nothing if not simple—animals, landscapes, children, flowers. Things of Victorian memory, like dismembered clasped hands and birds bearing tender sentiments in their beaks, may possibly return with a plebeian and sentimental culture. Draftsmanship may be stiff, execution crude, but in compensation, color will be slapped on with a dazzling trowel. Ornamentation and painstaking detail are typical of the cold culture cycle; hence portraits may play up every pore and show lint on the collar.

The gusty, good-hearted, uncritical sentimentality of the coming cold culture will express itself typically in comedy. Rather low comedy, even vulgar, but shaking with belly laughs and eminently good-natured. Audiences won't stand for tragedy and problem plays; popular dramatists of the next generation will hit the level already represented by the "big" comedians on today's radio programs.

Likewise, reading matter will impose no unendurable stresses on the intellect. Your cold culture novelist will write simple and descriptive stories dealing with ordinary lives of ordinary people. He may poke a little fun after the Dickens fashion. Poets will discard free verse, complex forms, obscurities, and return to simple rhymes of the Longfellow order. Ballads of the Horatius-at-the-Bridge order, telling dramatic stories in easy rhymes, will return to favor. Writing styles may tend to be a little more formal, for grammarians (who are not too highly respected during warm cycles) will swing more weight and writers will strive harder to be "correct."

Music should follow a similar course. Pleasing melodies of the Stephen Foster type, and simple dance music of the Strauss waltz order, will dominate once again as the cycle of popular taste moves on. There will also be a place for bombastic and show-off music. If you yearn for an operatic career, better study Gilbert & Sullivan instead of Wagner and Verdi. Grand opera will dwindle, comic opera revive. There will be a resurgence of simple folk songs and hymns.

What kind of schools will tomorrow's children attend? These institutions promise once again to be ruled by the hickory stick; the vogue for "progressive" schools, in which there is some doubt whether the staff or the children are in authority, appears to be running its course. Discipline will return in earnest. So will the three R's, as education gets back to fundamentals. Even the major heresy of teaching youngsters the alphabet will probably be revived. Emphasis will be more on science and mathematics as opposed to the social sciences. Educational systems will be more widespread than ever and private schools and academies will grow in popularity.

Religion is a vital aspect of any culture. Its manifestations are [*Continued on page* 138]

Subtle humor and subdued drama are out: Entertainment in decades to come will be bombastic, slapstick, crude, gusty.

The harbor of Rio de Janeiro, one of the finest and most beautiful in the world. Sugar Loaf Mountain's famous cone is in the center.

CONTINENT OF TOMORROW

NO. 10: BRAZIL

by Henry Albert Phillips

Last in a series of articles taking you country by country through South America.

E. F. KIRK, of Manaos, Brazil, is a crotchety gent. If you can manage to get on his good side, however, he may take you up the Rio Negro to that forty mile stretch of shore front that he bought for a few thousand dollars. Some day, he says, he is going to get a hundred thousand for it.

"I had several hundred acres planted in Brazil nuts, which are about the most profitable investment in the whole Amazon country. You just set out the trees and that's the end of it. They bear fruit at the age of 8 and are in full production at 12, dropping a half ton of nuts a year. For the next hundred years, the trees keep right on growing, reaching a hundred feet in height and six feet in thickness. There is a waiting domestic and foreign market for all the Brazil nuts that you and everybody else can raise. No waste. Just Brazil nuts; or, cooking oil, or oil for the lubrication of fine machinery, or for straight illumination, or in the preparation of medical products, or in the

making of soap. The refuse is turned into feeding cakes for the stock. Beat that record, if you can!"

Kirk went to Manaos, one-time rubber capital of the world, 40 years ago, when Brazilian wild rubber was king. He was wise enough to let rubber alone and go into something that he could do better than anybody else, with the result that he was not among the thousands of casualties that followed the bursting of the rubber bubble. He stuck to his profession as a mechanical engineer, with emphasis on public works.

Jack Brown belongs to the other school of Yanqui prospectors who went adventuring into Brazil. Like Kirk, he was an engineer. He remained in Rio de Janeiro, the capital, just long enough to hear a lot of talk about a place called Porto Alegre—3,000 miles south of Kirk's Manaos, and in the opposite direction out of the capital. They are two different lands, in fact, in two separate zones. Manaos is almost on the equator, in the heart of the deep tropics; Porto Alegre is semi-temperate, with a climate like northern Florida, only a little more so, both ways. The thermometer reaches 80 in their January midsummer, and drops to 50 in July. Brown engineered on the city public works

Relief map shows coastal plain, inland plateau, and location of principal products. Most of this vast area is untouched by civilization.

Huge herds of sheep graze on the limitless acres of the Mato Grosso plateau. Sheep and cattle raising are two of Brazil's largest industries.

Beef hung out to dry in a beef-packing plant in Sao Paulo.

during the week, and on week-ends worked a thousand-acre farm that he bought fifteen or twenty miles out of town. The Porto Alegre he went to had been a gangling provincial town. When he left it, it had grown to more than 300,000, with 16-story buildings on the main square and a traffic system that would get first prize anywhere in the world!

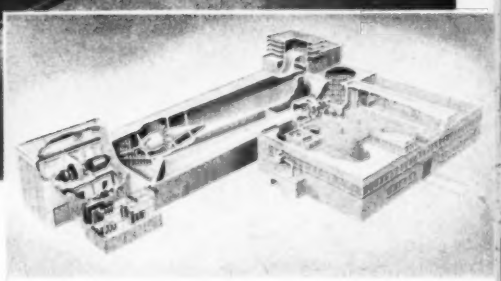
It is important that you get partially organized at least, before stepping onto boat or plane for Brazil. Otherwise, you might become so bewildered when you get down there that you would never get over it. You can't go poking here and there about Brazil and get anywhere, even though you give a lifetime to it. For two reasons: first, because Brazil is as big as our tremendous U. S. A. with Texas thrown in. Second, Brazil occupies about a third of all South America and is probably the most difficult country in which to travel south of the Rio Grande. The airplane is the only way to get anywhere quickly. There is plenty of ocean, and rivers no end, but traffic is all-fired slow, and there are no cross-cuts. Of no country in South America is it more true that "communities are isolated islands, amidst seas of jungles and untrod wildernesses."

It will take $500 and twelve weeks to get you down to Brazil and pay for a few weeks to look around. You had better get out of Rio soon, before you begin having too good a time, because it is one of the friendliest pleasure resorts in the world. It is just too beautiful to believe, with bathing beaches running right down into the heart of the town and jungle-like hills backing it up on the land side where the salubrious climate supports rare butterflies and orchids the year round. Furthermore it is one of the cheapest South American countries in which to live. One good boarding house overlooking the Sugar Loaf Mountain and the gorgeous bay used to charge about $30 a month. A milreis, which means a thousand reis, is good for just 5 American cents! So, count on $30 a month living expenses, not including transportation or equipment.

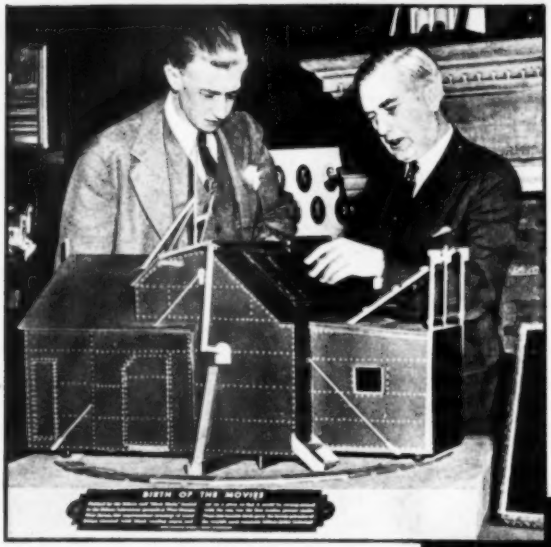
Everything and everybody goes to Rio first. There you will meet men on their way into, or out of, the interior. They all sound one note in common, that Brazil is the fastest progressing country south of the border. It has open spaces, raw materials, natural riches, plenty of money, and American support and prestige right behind it.

There are a [*Continued on page* 152]

SCIENCE IN PICTURES



THIS giant 24-foot fan sends a mass of air hurtling through the wind tunnel at Boeing's new Allen Memorial Aeronautical Laboratories at 700 m.p.h.! A solid steel driveshaft, 37 feet long and 16 inches in diameter, makes over 500 r.p.m. powered by an 18,000 horsepower electric motor. Models or sections of real planes up to 11 feet wide can be tested. Named for an ace test pilot killed last year, the tunnel's 450-foot rectangular length will be used to devise ways of overcoming the greatest obstacle to higher speeds, the 750 m.p.h. speed of sound. The laboratories permit engineers to design, build, and test planes under one roof.



"Black Maria," Birthplace Of The Movies

THIS is a model of the "Black Maria," the original studio built by Thomas Edison for the making of the first motion pictures just fifty years ago. In this picture, taken in the famous inventor's library and office at his company's plant, his son, ex-Governor of New Jersey Charles Edison, is explaining to John Coakley its construction and operation. Note the circular track on which the studio rests, permitting it to be moved around to catch the sun.

Dust Storms Brought Indoors

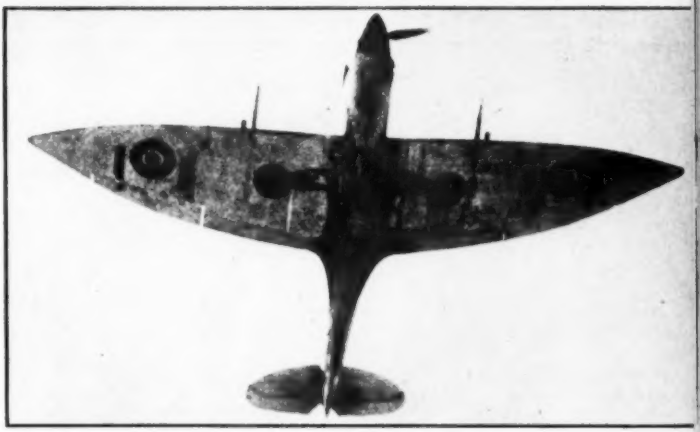
IN A "dust bowl" in South Bend built by Studebaker, barrelsful of fine sand brought from the Mohave Desert are whipped up into the equivalent of terrific desert storms to test vehicles to be used in battle areas. Paddle wheels mounted eccentrically on hubs simulate rough terrain. Worker dressed for protection against penetrating sand is shoveling it under front paddle of remote-controlled truck.

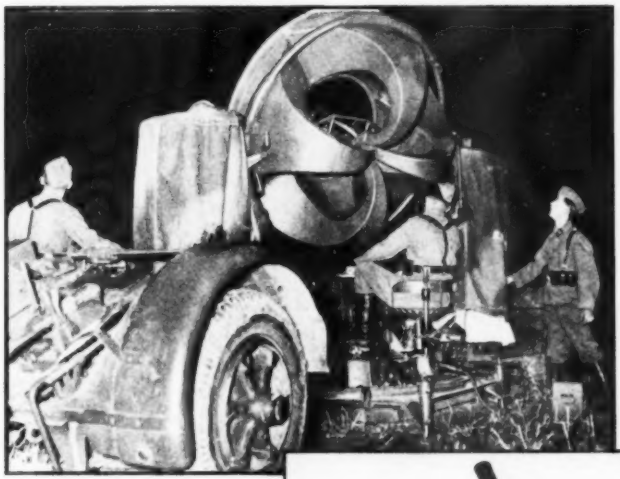
At Last, A Workable Gas Turbine

ENGINEERS and scientists have for a generation knocked their heads against the apparently unsolvable problem of the gas turbine, which they knew would be a potent source of power—if it could be made to work. Not till metal alloys were developed that could stand the terrific heat necessary to the turbine's operation did the power plant become possible.

Straining For Higher Altitudes

ABOUT four feet of pointed tips have been added to the 36-foot, 10-inch wing span of the Supermarine "Spitfire IX" fighter planes to lift them 2,000 feet above present ceiling. Armament consists of two 20-mm. cannon and four .303-cal. machine guns.



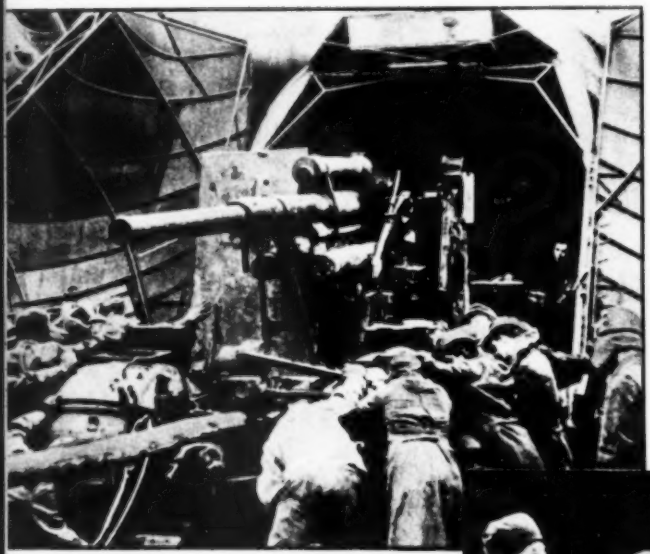


Listening For D-Day's Avenging Armadas

NAZI soldiers man a West Wall listening device that detects the approach of Allied planes. The Germans have been boasting recently of the strength of their Atlantic coast fortifications, but all this device does for them is let them know a little earlier of the coming of the great Allied fleets that they are powerless to stop.

Thirty Tons Of Stratosphere Gun

FIRST picture of the Army's new heaven-piercing anti-aircraft gun, which fires a 4.7 inch projectile 11 miles into the stratosphere, higher than any of today's planes can fly, and 20,000 feet above the range of any other gun. It can be depressed for use against ground targets, and can be operated either manually or by remote control.



Turning Their Guns To The West

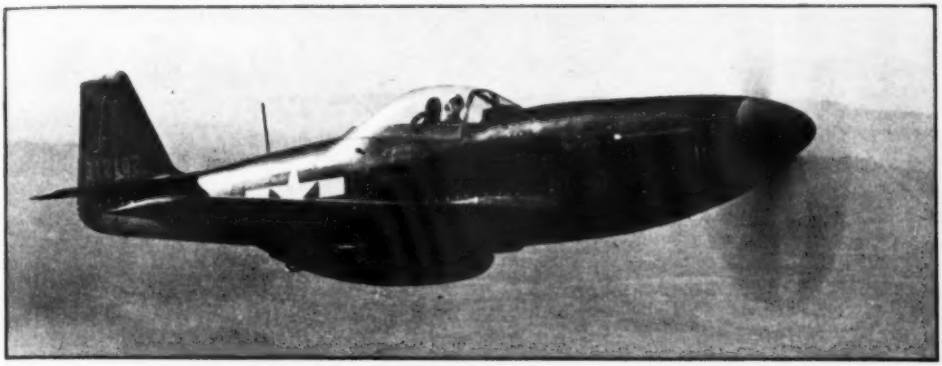
NAZI soldiers are huffing and puffing this big anti-aircraft gun into the nose of a big Me-323 "Giant" transport plane somewhere on the eastern front. Though short of both men and equipment for use against the implacably advancing Russians, the Germans show their real fear of Allied invasion by moving such weapons as these to the West Wall. Me-323 is Germans' largest plane.

Another Nazi Atrocity?

IS THIS a wretched hostage about to undergo some fiendish Nazi torture? Or is it Professor Sauerkraut doing his Human Cannonball act? In a word: No. The prosaic truth is that the guns along the West Wall tend to lose their showroom complexion and need periodic polishing, which this one is getting. It's all a great bore.

An Aerial Tank Buster

A JUNKERS 88, one of the Nazis' biggest bombers, is shown in this picture radioed from Sweden with a powerful anti-tank gun mounted below the fuselage. The plane is used to attack Allied tanks from the air, but the Nazis just don't have enough of them for use both against the Russians on the Eastern Front and the western Allies forging into France.



Newest Mustang Has Increased Firepower

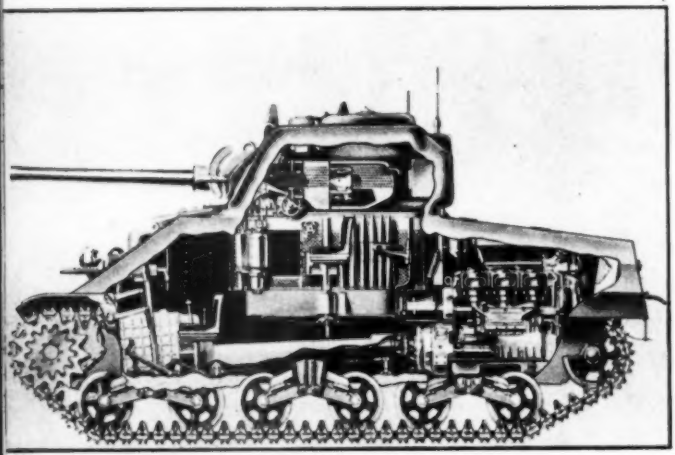
THOUGH P-51 is one of the greatest planes in respect to speed, range, and ceiling, this latest version has added firepower and a new "teardrop" cockpit enclosure giving the pilot complete vision. It's an aid to night-fighting, too: it can be rolled back to give view of surrounding sky unhindered by light reflections from instrument panel.

Now All It Needs Is Skis

THE addition of pontoons-with-wheels permits this tough, capacious Douglas Amphibian C-47 transport to carry its big loads to almost every battlefront and put them down on land or sea. The C-47 is one of the few American planes to have this type of amphibian landing gear.

A Mosquito With The Kick Of A Truckhorse

THE name "Mosquito" applied to this versatile RAF plane is becoming a misnomer. Equipped with a 2-ton Blockbuster, it now attacks Germany both by day and night. The Mosquito also has enough speed and maneuverability to be a formidable night-fighter, as the Nazis have learned.



The Anatomy Of General Sherman

THIS cutaway drawing of an M-4 medium tank, the General Sherman, reveals the business-like interior. If you look carefully, you'll see, among other things, the driver's seat (at left), the shells for the 75 mm. cannon (just below the cannon breech), and the observer's seat. Look at the sheer bulk of the powerful engine in proportion to Tank's size.

Nazi Tank Shows Russian Influence

THIS new 45-ton German tank, the "Panther," demonstrates respect for the Russian models. Both the long sloping front and the tracks are copied from Red Army types. The exceptionally long gun is a 7.5 cm. high velocity model (2.95 inches). Alongside it in the turret is a machine gun. The thickest armor measures 4 inches and is found on the gun mantlet.

German "Remote Control" Baby Tank

HERE is the latest and clearest picture of the over-ingenious German miniature tank that was used against the Allies in Italy. This one was knocked out by machine gun fire and recovered for examination. Called "Doodlebug" by us, it was one of four explosive-filled "secret weapons" used at Cisterna.

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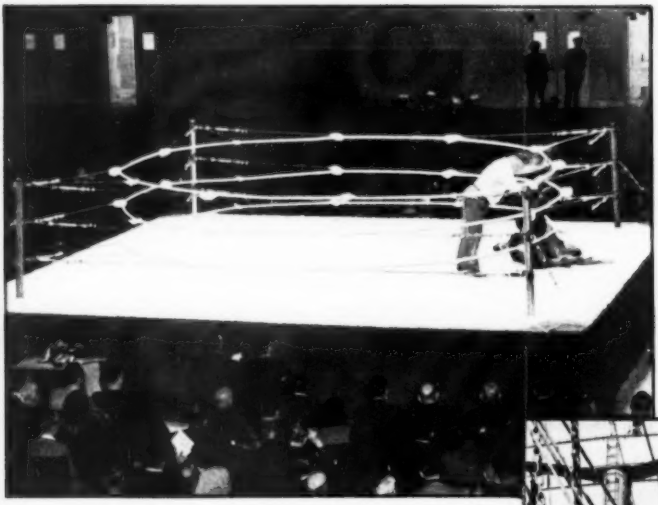
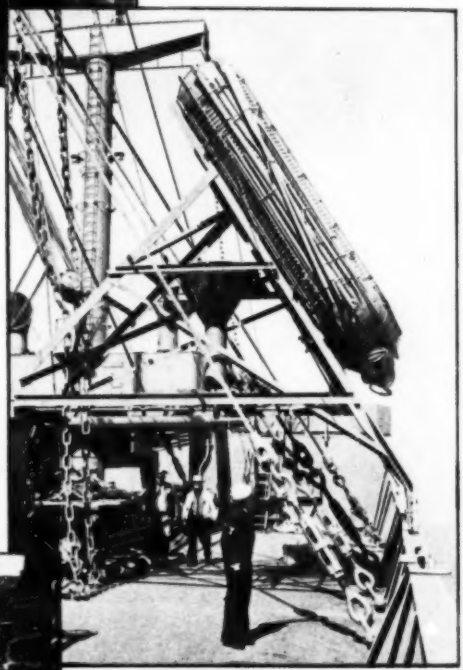


Circling The Square

APPARENTLY to make it easier for the boys to go around in circles, this new round boxing and wrestling ring has been developed by a sport's editor. The gentlemen in this San Francisco ring seem to be indifferent to modern design. Old-fashioned boys at heart, they prefer their usual stamping grounds, the mat.

To Take The Terror Out Of Shipwreck At Sea

BEING cast adrift on the ocean in a life-boat will always be a grim business, but this new type raft goes far to make it safe and endurable. Placed on a cradle so that it can be released at the touch of a trigger, it can be used either side up. Its 19 water-proof compartments guarantee buoyancy and also hold more than half a ton of supplies, including mast, oars, sail, food, blankets, fishing kits, sea anchor, storm oil, Bible—and playing cards. A canopy shelters from the sun.



George VI Inspects Some New Equipment

BRITISH machine gunners equipped with new Yukon packs are being inspected by their king. The pack is like a small stretcher and was developed to give the gunners complete freedom of movement of their arms.

Underbelly Of A Marauder

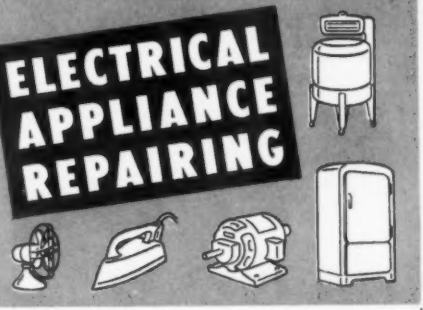
THIS unusual picture, taken from a following plane, shows the underside of a B-26 Marauder with its bomb-bay doors open in the second before the bombs were released to rain down on an Italian railroad bridge.

Close-Up Of 2-Man Torpedo

HERE is the latest and best picture of the new British weapon that was described in last month's MECHANIX ILLUSTRATED.

America's War Made Industry—

ELECTRICAL APPLIANCE REPAIRING



OFFERS BIG MONEY—INDEPENDENCE

The restrictions on the manufacture of electrical home appliances has greatly increased the need for and earnings of skilled home appliance repairmen. Always a good business, today ELECTRICAL APPLIANCE REPAIRING is one of the most profitable occupations that the average mechanically inclined man can turn to. On many types of repairs it is usual for a repairman to charge on the basis of $5.00 to $6.00 an hour! Work as many hours as you wish—a home appliance repairman is his own boss. Operate from your garage, basement, vacant store, etc.

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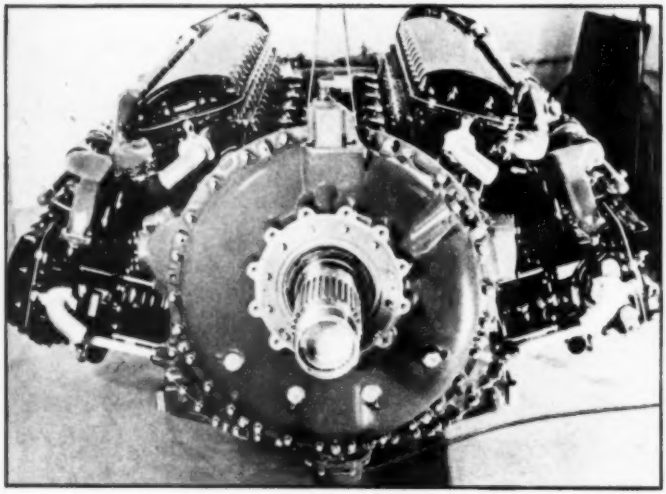


Most Powerful Aircraft Engine

THIS squat, but trim-looking monster is the latest version of the Allison Liquid-Cooled engine—but with what a difference! This has four banks of 24 cylinders, instead of two banks of 12, as on present models which power such planes as the Lightning, the Mustang, the Airacobra, and the Warhawk. This latest model develops 3,000 horsepower!

A Hotel For Post War Air Tourists

A FEW years hence, when you set out on a trip, you can be sure of "Tourists' Accommodations" for the night at such a hotel as this. Land either on the air strip or on the water, and have a swim before dinner. National systems of "air roads" dotted with country clubs and hotel resorts are advocated by William A. Mara of Consolidated-Vultee.

A Realistic Replacement Hand

ARTIFICIAL hands so realistic they defy detection are molded by Beaver Edwards, sculptor, for service men. Realism is attained by putting hair on back of hand. Edwards begins by making a mold of the remaining hand, then reverses it. Mrs. Ida Hibbard, shown in the picture, runs a Non-Profit Fund to pay all costs.

WAVES TAKE OVER

Women's reservists, 2,000 of them, march smartly in Virginia parade.

ON THE eve of their second anniversary (they'll be two years old on July 30th) the Waves are 83,000 strong and really going places. They've already released 73,000 men for active duty, hope to do much better. In many Navy establishments 20 percent of the personnel consists of these women reservists. Greatest need of the moment is for women test pilots, parachute riggers, photographers, telegraphers, aerologists, link trainers, radio and gunnery instructors.

Ensign Madeline Burks of Troy, Ala., is one of many Waves studying aerial navigation at Hollywood, Fla.

Yeoman 3rd Class Lillian Fay is on the beam, learning how to operate a cutter's 12-inch blinker light.

Aviation Machinist's Mate Violet Falkum turns over a propeller at the Naval Air Station, Jacksonville.

Jean Selby and Betty Brown once worked in Hollywood studios—now they make military cartoons in the Navy.

EDITOR'S NOTE...

Start planning your postwar week-end jaunts to Trinidad or Timbuctoo right now—there'll be plenty of luxury airliners to take you there. Starting on this page, the editors of MECHANIX ILLUSTRATED present a special eight-page section on "SKY GIANTS OF THE FUTURE," a preview of the flying pullmans and cargo haulers that will be serving you when the war's over. Below is a detailed story on Budd's brand-new stainless-steel sky wagon; on the following pages, intimate glimpses of Consolidated-Vultee's Model 39, the super-duper British Miles "X" and a round-up of other transports.

WAGON WITH WINGS

The knob-nosed Conestoga, with its wrinkled skin and high-flung tail, is the ideal aerial freight-hauler.

by John LaCerda

AN AIRFIELD wag sauntered up to Bill Page, who has test-flown more flying machines than you can spin a prop at.

"Listen, Bill," he quipped, nodding toward Budd Manufacturing Co.'s knob-nosed cargo carrier, "do you think that thing will ever replace the airplane?"

Bill gave the wit a full-throttle staredown, for he is one of the dozen or so sold-on-steel airmen who put the brand new Conestoga, designated the RB-1 by the Navy, through her trial paces. To him she comes close to being, from a safety standpoint, a pilot's dream ship. To the Navy, which has just accepted her, she looks like the answer to a skyful of operational and maintenance problems.

Being of steel, the Conestoga is, first of all, tough—perhaps the toughest twin-engined airplane yet bred by the needs of war. Withal, though, she is an aerodynamic plug-ugly. Around the landing strips they call her "The Bullhead" or "Pregnant Connie" or "The Winged Wagon."

The latter nickname probably is the most apt, for the bulging sweep of her lines does in fact resemble the contours of the Conestoga covered wagons that carried America's pioneers to the West.

If the Conestoga is a bit hard on eyes accustomed to more conventional lines, the pilots don't mind. They know that if she cracks up head-on her cargo won't come slamming into their backs—it will slide under their high-placed compartment. They know that if forced down at sea she will, although a land plane, stay afloat indefinitely because of her broad beam, high wing, and watertight doors. As a matter of fact, if you raised the

The Conestoga, 68 feet in length, has a 100-foot wing-spread, and can travel 200 mph.

engines a bit and added a couple of wing floats, she'd be able to keep company with the flying boats.

If fire, the scourge of the air, breaks out, pilots know that the Conestoga's steel skin and girders will hold together against temperatures up to 1,100 degrees Fahrenheit, compared with about 660 degrees for aluminum alloys. If emergency repairs are needed, her sheathing, only a little thinner than that used on Budd's streamlined trains and trailer-truck bodies, can be welded, bolted, riveted, or—and here's a definite advantage over aluminum—soldered. Every auto mechanic knows how to use a soldering iron and thus becomes a potential aircraft repairman.

This wagon of the clouds has a high-flung tail that reaches 31 feet 9 inches above the ground. Twice during test hops around the country she had to be tipped back on her tricycle landing gear to squeeze inside hangars that comfortably accommodate Flying Fortresses and Liberators.

There's another thing about her empennage which plane watchers around the world are going to notice. Her horizontal stabilizers, sharply dihedral, resemble those of the PBY flying boats which, incidentally, the Conestoga's designer, Russian-born Dr. Michael Watter, had a hand in perfecting before he signed on with Budd in 1939.

Unlike other aircraft, the Conestoga has its main loading hatch in the rear of the underbody. The door of the hatch actually is part of the fuselage. Let down, it forms a ramp reaching to the ground; partly lowered, it is level with the loading platforms of the trucks which can back right in under the tail structure.

Wholly unobstructed by structural members because of the innovations possible through use of steel, the cargo compartment is 25 feet long, eight feet wide and eight feet high. This adds up to space for 10,400 pounds of payload against total loaded weight for the ship of 33,800 pounds. Into her can be snuggled four Army jeeps, or an ambulance and half an amphibious "duck," if you can conceive of half a "duck" ever being around loose anywhere.

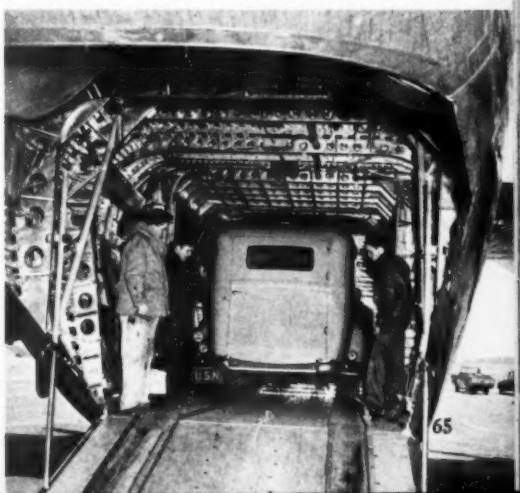
With 1,600 cubic feet of cargo space and a wingloading of about 24.2 pounds per square foot, the Conestoga's ratio of payload to weight, Dr. Watter says, is from 4 to 6 per cent better than that of conventional Allied

The Conestoga's swelled head means safety—in crack-ups her cargo will slide under the pilot's cockpit.

cargo planes, all but one of which are conversions from other designs, military or commercial. Dr. Watter figures that a projected peacetime version of the Conestoga, with more powerful engines—the Pratt & Whitney radials now used deliver 1,200 horsepower each—should give even greater efficiency.

Budd's steel is roughly three times heavier than the usual flight metals. But at the same time it is three times stronger; hence not so much metal is needed. On the Conestoga's engine mounts, for example, no tubing reinforcement is used. Inside the cargo compartment, her bracing is like that of a boxcar.

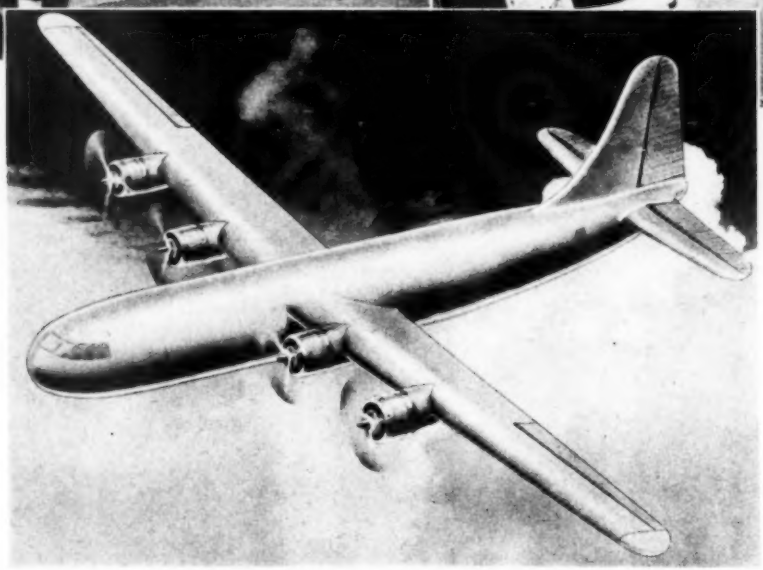
A brand new method of attaching the wing is responsible in part for the Conestoga's unusually large cargo space. The wing structure itself does not pass through the ship; instead, it comes in two main sections which are anchored to five special side frames jutting out of the fuselage. These side frames are joined across the body by shallow but rigid transverse members. [*Continued on page* 154]



Steel construction eliminates structural members and leaves room for no less than four jeeps in the plane.

FLYING PULLMAN

KNOWN as the Model 39, this 48-passenger airliner is Consolidated-Vultee's bid for postwar air. With a 240-mile cruising speed and a range of over 4,000 miles, it has already been test-flown. No less than 24 persons can be slept in this luxury liner, whose seats are convertible into berths (the upper berths swing down from overhead). Polaroid windows give any degree of light desired.



TOMORROW'S AIR TRANSPORTS

The Miles "X"—British bid for postwar air. Range—3,450 miles. To carry 50 passengers and crew of five at 350 m.p.h. MI painting by Fred Ripperda.

Science in Color

What postwar airplanes will make this world your travel oyster?

THIS decade, in the most literal sense, is up in the air. Witness this single eloquent statistic: As recently as 1939, the dollar value of aircraft production placed it 44th among American industries. In 1943 it was first. There, in a nutshell, is the phenomenon of the Forties.

But the role of aircraft in warfare, and even more in the peace to come, is far from being fully defined. It was only this year that the real air war got under way, with the great pre-invasion air offensive against Germany, the smashing raids on the Marshalls, Truk and the Marianas by the greatest aircraft carrier forces ever assembled. "The face of war and the nature of living," says Hanson Baldwin, "are just beginning to be altered by air power in its various forms." And only a few months ago Brig. Gen. Edgar P. Sorensen, former Assistant Chief of Air Staff for

The "China Clipper"—Pan American's famous B314 transoceanic flying boat built by Boeing. A prewar transport.

Intelligence, stated that "Air power is now possibly little more advanced than was sea power at the time Phoenician traders were arming their galleys for use in raiding other shores."

In short, the biggest things in the air are yet to come. In the words of one observer, "The tactics and techniques of the third dimension are still in almost daily flux." As they approach sharper definition, we shall find our ways of life profoundly altered.

Already our concept of the globe has shifted radically. The geography-book picture of the earth as a sphere 25,000 miles round is one thing. A world so greatly shrunk that no spot on its surface is more than 60 air hours from your home town is something else again. Zambesi, Patagonia, Bagdad, Irkutsk—all the legendary places are now within easy reach, closer than many summer resorts used to be. Pan-American Airways isn't kidding when it advertises a week-end jaunt to Paris as soon as the war ends, to compete with your old-fashioned excursion to the mountains.

And our old ideas of directions are being thrown on the junkpile. There was a time when you went west from New York to China, east from New York to Europe. Today, for both, you go north—the shortest, fastest way.

The pre-war Clipper route to China, for example, followed the old sea route—from San Francisco to Hawaii, then on to Midway, Guam and Hongkong. Today the air route cuts over Alaska, Siberia, the Gobi Desert and down into the heart of China. It's 4,000 miles shorter that way. The sea route from New York to Bombay, via Gibraltar and the Suez Canal, was 9,500 miles. Now, by air, with stopping points at Reykjavik, Moscow and Teheran, it's 7,800 miles. The sea

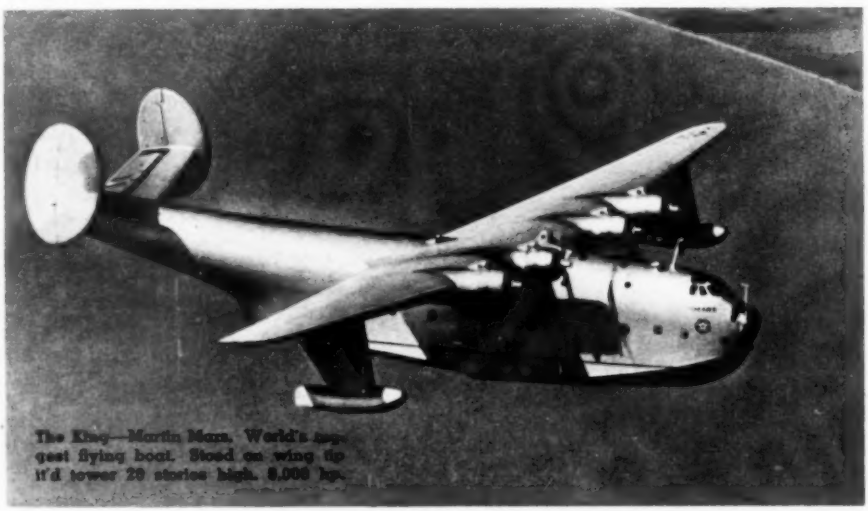
The Boeing 307 "Stratoliner"—the great four-engine prewar plane that operated at 14,000-20,000 ft. TWA's best.

Above, the lounge of the British eight-engine Miles, complete with easy chairs, game tables and bar, will put to shame almost anything earthbound streamliners can offer. The cockpit (below) is the last word in visibility and spaciousness for transport pilots. It's practically a complete Waldorf-Astoria with wings!

The latest—Lockheed Constellation. Howard Hughes crossed the country in this baby in just 418 minutes.

journey took three weeks. The flight takes 39 hours.

Similarly, by air Moscow is closer to Chicago than to New York. From Kiska it's almost the same distance to both Detroit and San Diego. Seattle to Calcutta is 12,000 miles by sea, as against 7,200 miles by air. And already, as the headlines keep telling us, airmen are nonchalantly hopping the Atlantic in a mere 400 minutes by Flying Fortress.



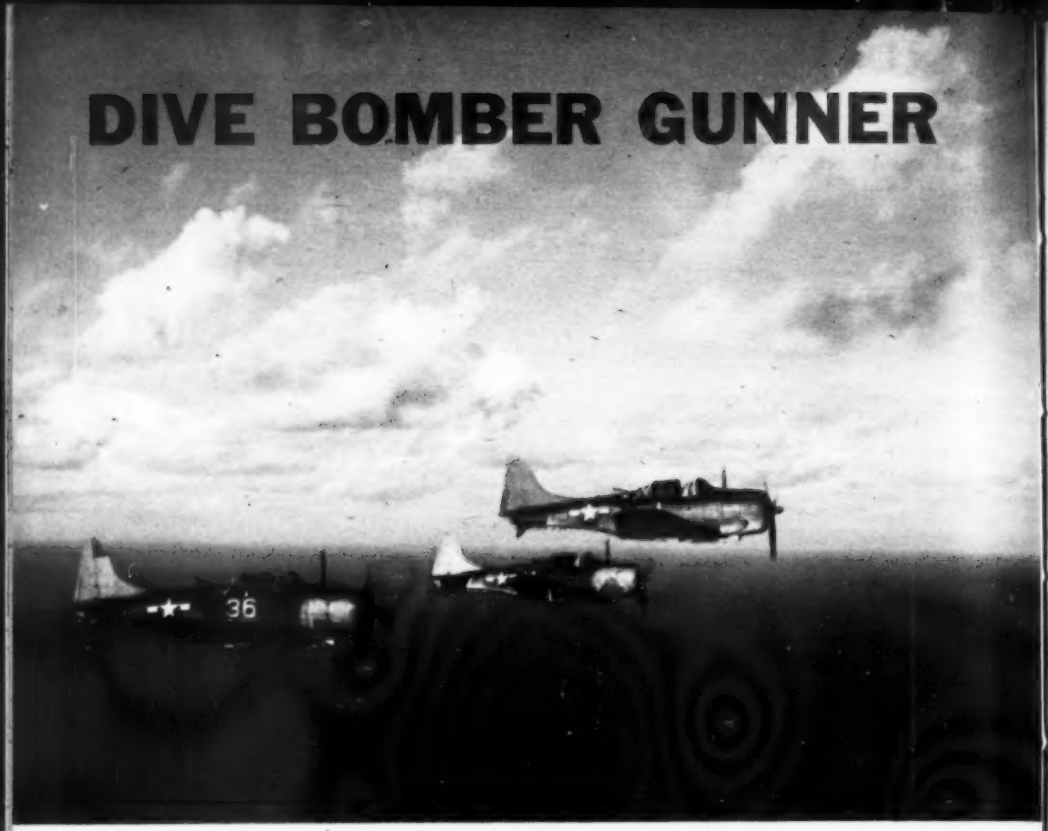
The King—Martin Mars. World's biggest flying boat. Stood on wing tip it'd tower 20 stories high. 8,000 hp.

Aerial work horses. Ex-airliner C-47 Skytrain. This Douglass freight hauler was grabbed for war duties.

Our old mercator maps, designed for earth-bound globe-trotters, pictured the world as the flat projection of a cylinder, not a sphere. They were a product of the days of ocean travel, good chiefly for east-west navigation and accurate only at the equator. As you move away from the equator the distortion becomes so great that little Greenland, for instance, looms up large enough to dwarf all North America. [*Continued on page* 142]

And the greater Skymaster, C-54, developed by a pool of air lines, was ATC's big four-engine break.

DIVE BOMBER GUNNER



Douglass Dauntless dive bombers (SBD3's) winging out over the Pacific. Their two-man crews spell sudden death for enemy craft and troops, as Japs have learned.

From Rabaul to Truk with a Dauntless rear gunner-radioman—the lad who goes down backward blasting enemy planes from the skies.

by J. F. Swingle, ARM

WHEN I was in high school in my home town, Lansdowne, Pa., a few years ago, Armistice Day was different from other days: there were speeches in the morning and two minutes of silence at eleven o'clock and a boy from the band blew taps; the flags were out, people wore poppies, and the President made a speech on the radio. But out in the Pacific last year, Armistice Day was just another working day. At eleven o'clock I was flying back from bombing Rabaul in the gunner's seat of a dive bomber with shrapnel and machine gun bullets in my leg. That's the toughest mission I've been on yet—it was worse than Truk.

It was pretty dangerous, too, because our task force was a small one. We got within 200 miles of Rabaul before the planes took off and headed north. It was pretty good going until we were about thirty miles from the Jap base; then 200 "Zekes"—Zeros—picked us up and followed us all the way in. It was a funny thing, but they didn't bother us much then. What I've seen of them, they're not particularly shy, but these Japs seemed to be holding off. I realized later that they were waiting until we broke formation. We had a full squadron—28 planes—of our "Dauntless" dive bombers, Douglas SBD's, and about 70 fighters for protection.

Rabaul is at the north end of one of two parallel islands. We flew in over St. George channel between them and past the air field to our target, a light cruiser in Simpson harbor. Because they were expecting us, their anti-aircraft guns were blazing away when we got there. The flak was exploding pretty close to us as Lt. (j.g.) W. R. Davidson

Official U. S. Navy Photographs

pushed the plane over and we dived through the flak toward the ship. We pulled out of the dive and started hedge-hopping across the harbor. I thought it was funny that I didn't see the bomb go off, but I was too busy keeping my eyes on the Jap fighters to think about it.

But going down the harbor I noticed that all our planes were passing us. I looked down at the bomb rack and saw the 1,000-pounder still there—the release hadn't worked. We went on low over the harbor—that flak was awful close—but we got through it and I thought we were O.K. I had forgotten about the Zekes when suddenly I spotted two of them, one on each side of us. The one on the starboard was closer so I trained my two .50 caliber machine guns on him. I just had time to see I had hit him when one of his 20 mm. bullets burst in the ammunition case below and behind me. It blew up with an awful roar and spattered shrapnel into the cockpit and into my leg. I kept firing at him until he rolled off, but I felt some more stuff go into my leg.

I couldn't stop to look at it then because there was the other Zeke on the port side. I turned the guns around and gave him a couple of bursts. He swung off before he had done any damage, and no more came around for awhile.

My leg was bleeding pretty bad. I looked around the cockpit for something to use as a tourniquet and the only thing I could see that would do was the mike cord—the wire from my telephone mouthpiece that went to Mr. Davidson's earphones. I called to him over the phone and told him I wouldn't be talking any more because I was going to pull out the cord. He had been hit in the leg and a bullet had grazed his head but he was flying darn good evasion tactics.

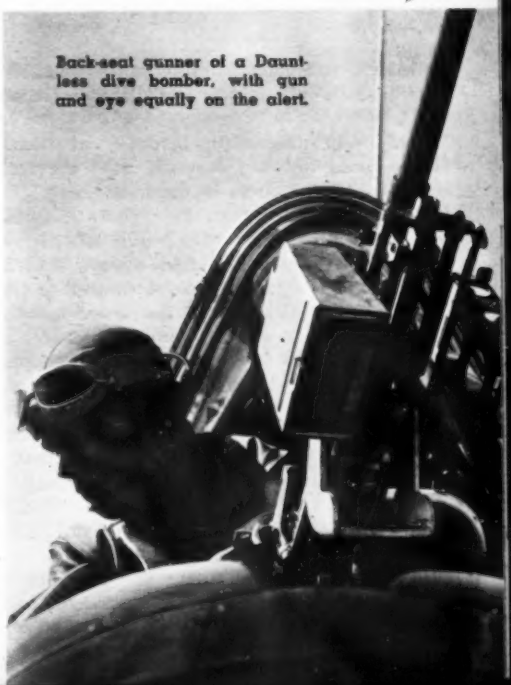
It wasn't until then that I noticed blue smoke coming from the front of the plane and I was really scared. I thought the gas tanks were on fire but when I got a better look I saw that the oil lines had been hit, probably by flak when we dived over the cruiser. The gas tanks in the wing had been punctured too, but they were self-sealing. Oil was spattering all over the plane and there was a lot of smoke curling over the wings.

We rendezvoused with the other planes of the squadron at the place that had been fixed before the attack and Mr. Davidson got to work on getting rid of that bomb. The release switch didn't have any effect, so he jerked the stick back and forth hard and the plane shook. It took him quite a time to get the bomb loose, but when the half-ton of dead weight fell away the plane picked up speed.

By this time we were away from the harbor and heading down St. George channel. We joined up with another plane and he kept the Zekes away. We didn't have any more trouble with them, but we had a long, two-and-a-half hour run back to the carrier. Because of the shape we were in, we got a DEL—a Deferred Emergency Landing. Usually the fighters land first because they have the shortest flying time, then the torpedo planes, and finally the dive bombers. This time we were the second plane to hit the deck.

My leg wasn't hurting so bad so I walked down to the ready room and took off my flight jacket. I reported the Jap I had hit but because no one else saw it I only got a probable. Then I went to the sick bay. The doctor was operating on my leg, taking out 17 pieces of shrapnel and two 7.7 mm. bullets, when two Jap air groups attacked us. They made a near miss just aft of the sick bay that gave us a bad few seconds, but the ship's AA guns and the fighters shot all of them down.

From Rabaul we headed for Tarawa. I was in sick bay while we were there, but the boys tell me they had an easy time of it. They made a few bombing raids and met very little opposition. After Tarawa we went to



Back-seat gunner of a Dauntless dive bomber, with gun and eye equally on the alert.

SBD3's (Dauntless dive bombers) neatly carrier packed. They're sturdy in any league, built for the job; but—

Kwajalein and made some hit-and-run raids but the Japs left us pretty well alone there, too.

I had my nineteenth birthday at Pearl Harbor and finished two years of service, seven months of them in the battle area. It seemed like more than two years since I joined up and put in for radio school. I wanted that because I had always fooled around with radio at home—I wanted to be a radio engineer. After the three-month course I volunteered for gunnery school, a one-month course. I went to gunnery schools in Jacksonville, Norfolk, and at Pearl, where we trained with .30 and .50 caliber machine guns until we knew every part of them by heart and had practiced firing them thousands of times under realistic conditions. Besides us radiomen there were aviation machinist's mates and aviation ordnancemen training to be gunners.

I didn't know much about the job when I volunteered. I guess I did it just for the fun of it—before I learned. There used to be restrictions about the size of gunners, but I didn't have any trouble because I weighed about 155. It used to be that you got your silver wings only after three months of combatant duty, but now gunners get them on graduation from gunner's school.

After graduation we went to operational squadrons where we trained with full crews for six months. That's to give you experience in team work and in flying as close as possible to the real thing. We developed marksmanship doing trap and skeet shooting with shotguns, and we kept on doing that out in the fleet. Mornings when we weren't flying we shot at clay pigeons off the stern of the ship. Gunners fly in four different kinds of planes, dive- and torpedo-bombers, land-based bombers and patrol flying boats.

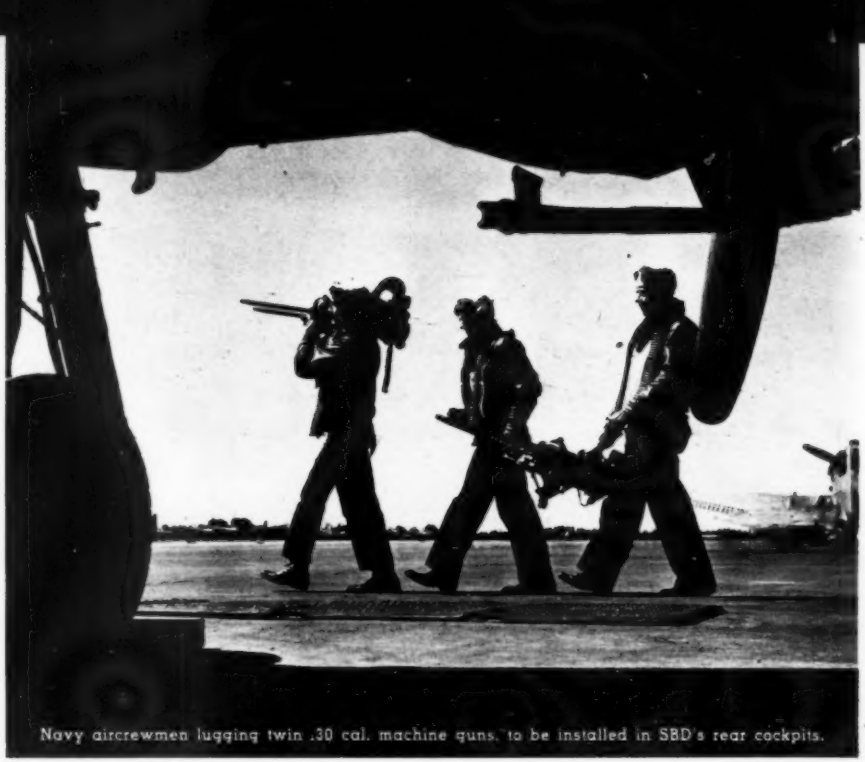
Out in the fleet aviation crewmen are not part of the ship's crew. Our one job is taking care of that back seat and all aviation radio and gun equipment. We even have our own

—say, are the dive bomber boys tickled to see those Wildcats or Hellcats peel off on sighting Jap fighters.

sleeping compartment and we spend most of our time, when not working, in the ready room. That's where we get our orders before going out on mission and where we report back after a flight. Every day we check on our guns and radios. Usually there are gunnery lectures and practice in the morning, and in the afternoon, recognition classes in planes and ships, and training films. Aviation crewmen spend a lot more time being prepared for combat than they spend in combat. I guess that in the seven months we were out we didn't fly in combat more than fifteen days. We don't practice shooting while flying because gas is too precious to allow it. Anyway, our squadron kept in practice very well—firing on the Japs.

The way it works out when you're in the combat area, any member of the aviation crew may have to fly the back seat as a gunner, and everyone has had enough gunnery and radio to be able to do it. It's an interesting job and you can get your rating fast. The ship's crew kidded us a lot because we didn't have to stand watches or scrub decks. Sometimes we might go for a week without flying. I fooled around with radio in my spare time and got first class just last March 1st. Of course, being in naval aviation, we get flight pay.

I've heard that in some squadrons being a gunner is considered pretty dangerous, but it wasn't more so than any other flying job in ours. We lost four men, two pilots and two gunners, and that was in action. Back in '42, when bombers sometimes had to fly without fighter protection, there were a lot more casualties, but now our fighters, which always go out with the dive- and torpedo-bombers, keep the Japs so busy that they don't get much of a chance to tangle with us. One of the pleasantest sights a rear gunner knows is that of Wildcats or Hellcats peeling off to give his plane protection. That's the kind of protection I always want plenty of. The SBD's we fly are slow, but they can take a lot of



Navy aircrewmen lugging twin .30 cal. machine guns, to be installed in SBD's rear cockpits.

punishment. The best protection a gunner can have is a good pilot, and in our squadron we have the best. I guess every gunner says that, but I know it's true. Mr. Davidson and I flew together for ten months, and I think he's the best pilot in the squadron.

And when it comes to being up in front where things happen, we aviation crewmen have ringside seats. We saw everything that went on at Marcus [*Continued on page* 142]

The OS2U, Navy scout, can rescue downed airmen in an emergency.

So G. I. Joe can plop plugs into foreign lakes, experts work gratis.

by Louis Hochman

Hand painting a casting and trolling plug in Harlan Major's workshop. Note the feathered lures, the other artificial baits.

TACKLE FOR THE TROOPS

AS ONE military authority put it, "War consists of long periods of monotony, punctuated by short periods of extreme excitement and activity." Sitting tight month after month on some tiny isle in the South Pacific, or in the Aleutians, or some other God-forsaken outpost in the middle of nowhere, with nothing to do for excitement but wait—can sap the morale of even the best of our fighting men.

But the G.I. Joes, who were torn away from their favorite fishing grounds back home to be transplanted to strange new lands and waters, aren't sitting around moping during their free time. They're having the time of their lives whipping new streams and catching strange fish with tackle most fighting fishermen would give an arm and a leg for. Hooks, reels, rods, lures and line of every description and quality are theirs for the asking, thanks to Harlan Major—well-known author and fisherman, who has made it his business to see that Johnny Doughboy doesn't let the "big one" get away for want of adequate fishing tackle.

It all began shortly after Pearl Harbor, when a friend of his, a sergeant stationed in Australia, wrote him about the Australian fish he couldn't catch because he couldn't find any tackle. Major sent him some of his own gear.

There are lancewood and split bamboo rods meant only for the expert's fingers and wrists—as well as heavy sea tackle.

Good chance lads above are using the tackle that (below, left to right) Bill Smith, Ivor Nordin, Winthrop Trowbridge put together.

Soon he was sending tackle to the men in his company, then to the whole regiment. Word of Major's generosity spread like wild-fire—to the Pacific, the Aleutians, the Mediterranean, North Africa. From every fighting front requests for tackle poured in, and Harlan Major found himself faced with a job he didn't have the heart to refuse.

He enlisted the help of friends who donated their surplus tackle for the cause. Manufacturers donated their salesmen's samples and items left in storage bins. Brother fishermen all over the country (and there are over 17,000,000 of them), got wind of the project and dug into their stockpiles of tackle laid away in closets for the duration.

Today, Harlan Major is no longer alone in his enterprise. Much of the equipment sent in by fishermen requires repair. This is done nightly in Major's basement home workshop at 115 East 35th Street in the heart of New York City. Volunteer workers, all enthusiastic sports fishermen, the kind that really catch fish, give up one night each week to meet at the workshop and repair and refit the equipment to go overseas. There are over 35 volunteers, skilled in repairing every kind of tackle, coming on different evenings, and the ranks are steadily increasing.

On Monday nights we may find Bill Smith, N. Y. Surf and Tournament Caster, busy splicing line and teaching a group how to make the shroud knot. Following his instructions may be John Janson, owner of a large wire-bending factory now on war work, who comes up each week from Newark, N. J., to lend a hand. At the other end of the table, you might find Nils Johnson, plant manager of a wire-bending factory, busily engaged in twisting wire leads on fish hooks with an ingenious little

machine he designed and built for the purpose.

Tuesday nights, a machinist group, whose hobby is building reels for their own use, comes up from Trenton, N. J., to work on the many reels that need repairing. Wednesday nights, we find Maxwell C. Baker, of Consolidated Edison, busy with his assistants retying and reviving flies over a steam kettle. M. O. Davis, Assistant Treasurer of the Brooklyn Union Gas Company, works hard at untangling snarled line. Hundreds of pounds of these snarls are donated regularly by cotton manufacturers now making camouflage netting for the armed forces.

Major himself supervises the work and is constantly figuring out ingenious methods of speeding up various phases of it. In this respect, he has devised many interesting gadgets, which he laughingly calls "Rube Goldbergs." One such gadget consists of a large, wooden, line-drying reel hooked up to a counter, which revolves by motor and winds up measured lengths of line, 12 at a time. Another gadget is designed to enamel line by running it through a metal trough containing the enameling solution. The enameled line travels down the length of the work table, and is so arranged that it is dry by the time it gets back to the trough for another coat. Chemist volunteer workers contribute their technical skill by working out the enameling formula to fit the project. Latest "Rube Goldberg" which is keeping Major awake nights trying to figure out, is a contraption that will take nine rolls of light line and twist them into one roll of heavy line.

Major's basement workshop is only about 12 feet wide and 35 feet long, but is so efficiently laid out that very frequently he has as many as 15 men working in it at a time turning out hundreds of [*Continued on page* 144]

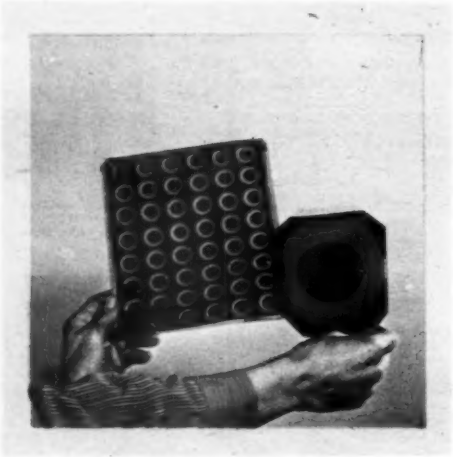
Max Baker, crack fresh water angler, fluffs up a crushed fly. Underneath, Nils Johnson leaders a hook with machine he designed, built.

BLACK AND

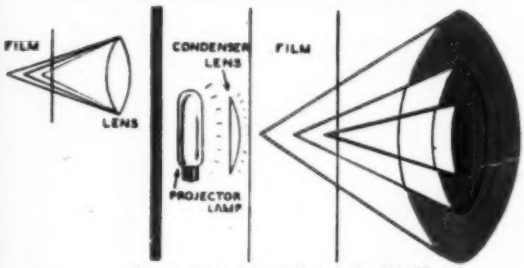
Latest news on the miraculous Iriscope, an M. I. "First," which projects color photographs from black and whites.

by George Daniels

The Iriscope is a filter, blue center, red outer rim, green in between. The inventor, H. C. Birch-Field, has experimented with many filter types, like those below.



Below left, common lens focuses primary components of white light in film. Right, Iriscope picks up colors in film, channels them back in their respective cones.



Photos by Constance Mitler—Graphic House

FRAUD! Sleight of hand!

So spoke photographic smart alecks when C. A. Birch-Field announced his Iriscope last year. Comments ran all the way from outright libel to the dogmatic assertion that the device was just too simple to work.

Today there is much blushing in the photographic world, for the Iriscope has proven to be an outstanding development in that field. It was completely described for the first time in the April, '43 issue of MECHANIX ILLUSTRATED. Yesterday's denouncers tell you they knew it was a great thing all along. From a leading color photographer comes the revelation that actual color prints of the wash off and corbro type can now be made from black and white film with its aid. These are not experimental jobs but quality color prints. They are well suited to Iriscope work at this stage of its development as the different color separation negatives can be manipulated to avoid any lack of balance.

As a result of the intensive experimental program that began with the inception of the Iriscope, the newest models produce far more brilliant colors from the same black and white films. A greater number of intermediate colors are also brought out by the present Iriscopes as they approach closer to the ultimate in color photography. The use of black and white film, of course, permits higher speed color photography than has ever before been possible.

The original layman's impression of the Iriscope is that it is an extremely simple device, and as far as operation and form are concerned, the impression is correct. As to the problems of design, however, the Iriscope is a scientific colossus. There are more than 20 million

WHITE MAKE COLOR

Birch-Field, Senior, has had an able assistant in his complex experiments. His son, Arthur Birch-Field (now with the U. S. Army), teamed up with him in the 1920's, went in for controlled tests in his home zoo at first.

possible combinations of the nine variable factors in the device. Like the earlier models, the latest Iriscope looks like a little transparent target with a blue bull's eye, a green intermediate ring, and a red outer ring.

The nine variable factors in the design stem from the bull's eye and the surrounding rings. Three variables are the areas allotted to each other. In other words, how big shall the bull's eye be, and how wide each ring? Next in line comes the selection of the wavelength for each of the three colors, in simpler terms, picking just exactly the correct shade or tint. Finally, the intensity or saturation of each color selected must be determined. If it still seems simple, bear in mind that experiments have shown that the slightest change in any one of these factors brings about a great change in performance.

Inventor Birch-Field has not worked alone on the complex maze of experiments that are constantly wringing more and more color from hitherto colorless film. Another member of the research and experiment team is Arthur Birch-Field, science-hungry son of the inventor. Their teamwork in the realm of science dates back to the 1920's when Larchmont, New York, formally named the road where they lived "Birch-Field Road." There in a big rambling house they maintained a thoroughly equipped experimental laboratory, an art gallery, and a menagerie complete with monkeys, parrots, strange fish, and various faunal oddities.

A short distance from the house, fronting on the tennis court, was the studio where the two inventors frequently passed some time with brush and palette. Not just a sideline, many of these paintings have carried the Birch-Field name to wide acclaim in the highest art circles.

In view of the inventor's artistic ability it is fitting that the first black and white film ever projected in color through an Iriscope was a shapely nude. Well developed, photographically speaking, the picture had

The inventor of the Iriscope achieved a sound reputation as an easel painter. Color sense came easy to this artist-scientist.

only the usual shades of lifeless gray until the Iriscope was set in place. Then warm flesh tones and dark eyes topped by a head of soft, brown hair made photographic history.

Arthur Birch-Field, now with the U. S. Army, did not confine himself to assisting his father in the technical development of the device, but also constructed the equipment used in the work. Since the younger Birch-Field entered the Army three years ago, inventor Birch-Field's work on the Iriscope has consisted mainly of intensive study and analysis of the optical phenomena involved.

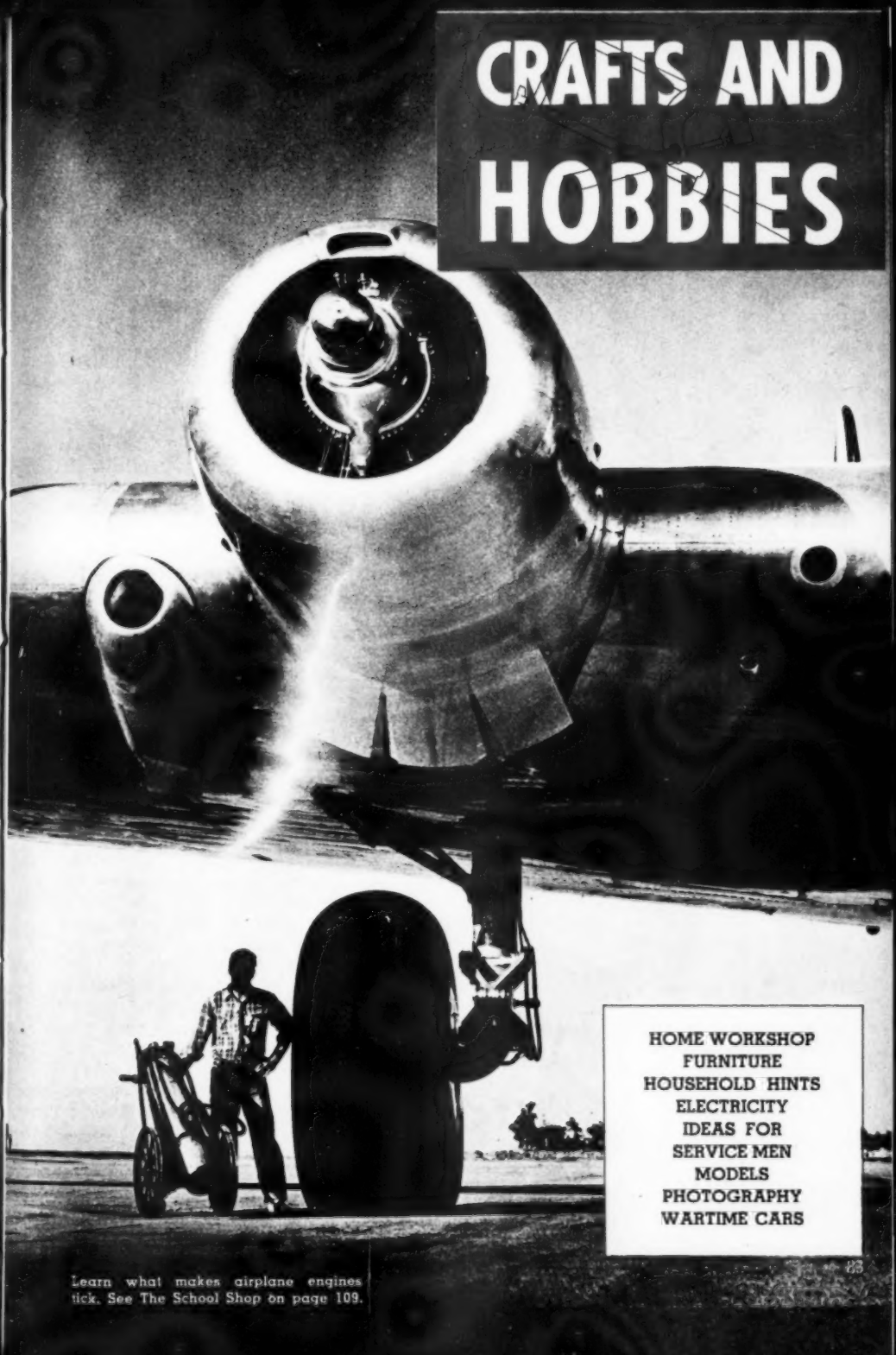
Iriscopic projection from black and white rainbows a screen.

Oddly enough, Birch-Field was not working on photography but on television when his research carried him into the little explored field of conic refraction, thence to the Iriscope idea. The Iriscope is based on the fact that light of different colors comes to a focus at slightly different distances after passing through a lens. This, Birch-Field coupled with the fact that all light striking a photographic film forms patterns according to its path of entry, and that light sent through the developed film later follows the same paths as the light that made the patterns. He reasoned further, that the different colors of light, with their different focal points, left their own individual patterns in the film—tell-tale pathways that light passing through the developed film would follow. In fact, light had been following those color-pattern pathways ever since photographs were first projected, but nobody had ever made any use of the fact.

The Birch-Field Iriscope puts a ring of the right color in each of these individual paths. Thus, when your projector bulb sends its white light through a portion of the film containing patterns made by red light, these microscopic film patterns direct the white light from that area through a red ring of the Iriscope before it reaches the projection screen. Likewise, blue is directed through the blue bull's eye of the Iriscope, and so on. The intermediate colors are automatically reproduced by combinations of the colors of the Iriscope rings.

More than 18,000 professional portrait photographers throughout the country can now open a tremendous new market for themselves by offering their clients genuine color prints from old negatives on file. Advertisers can soon be relieved of the necessity for sending color copy to the various publications in which they run their material, as the Iriscope needs only a black and white positive transparency, or a black and white negative from which the transparency can be made. Surgeons can photograph delicate operations.

CRAFTS AND HOBBIES



HOME WORKSHOP
FURNITURE
HOUSEHOLD HINTS
ELECTRICITY
IDEAS FOR
SERVICE MEN
MODELS
PHOTOGRAPHY
WARTIME CARS

Learn what makes airplane engines tick. See The School Shop on page 109.

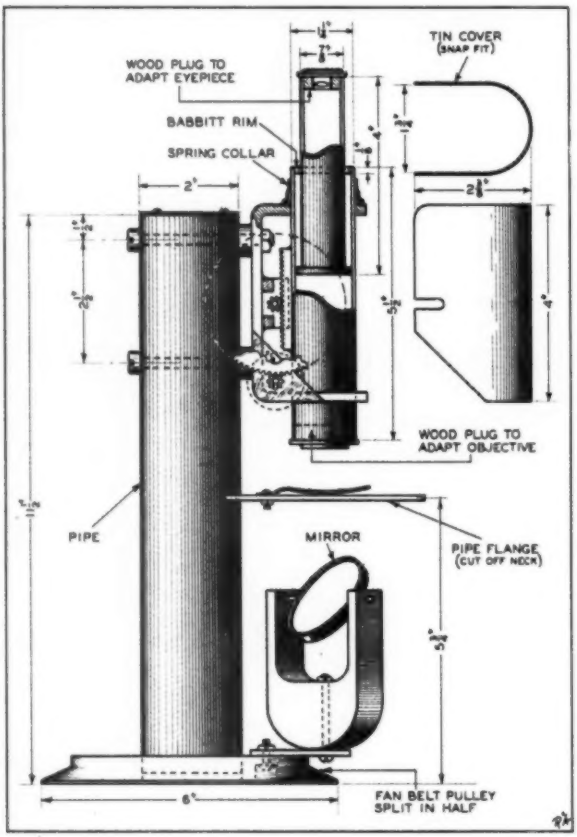
Microscope in use. Mirror was obtained from compact.

Microscope with Camera Attachment

This instrument is as practical as a high-power laboratory model and can be built of pipe with a few workshop tools.

by George Daniels

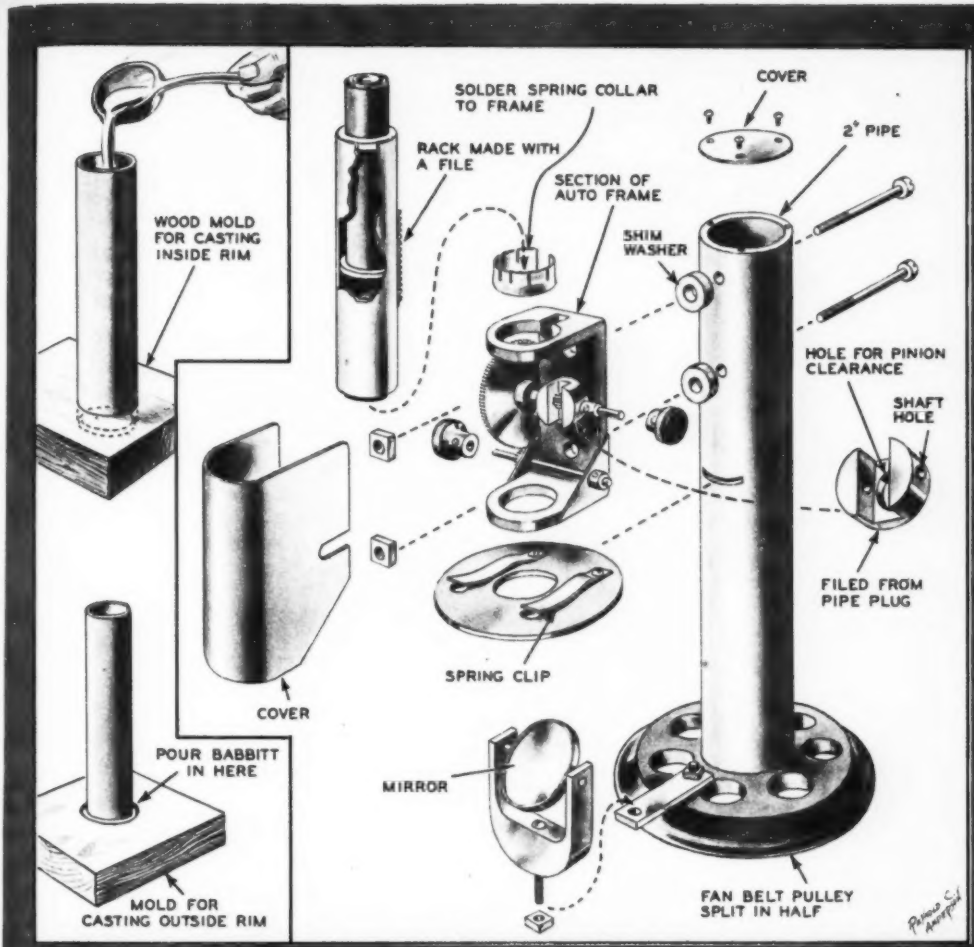
TWO or three dollars' worth of pipe and an old auto fan belt pulley provide the bulk of the materials with which to build this high performance, laboratory-type microscope. Slight modifications in dimensions will permit the use of lenses of practically any power, from the lowest and most inexpensive to the highest oil-immersion types. The latter can be bought second-hand for around $35, while the lower powers can be had from $5 or so upward.



The original instrument shown in the photos was designed for 1,500-power lenses costing $36.50, the dimensions of the telescoping tubes being based on the requirements of the lenses. To use the low-power variety, it is necessary merely to cut the tubes a bit shorter. The maximum and minimum distances between the eyepiece lens unit at the top and the objective lens unit at the bottom can be obtained from the dealer where the lenses are purchased.

A metal working lathe is not really necessary in building this microscope, although it will make some of the work easier. All lathe work required may be done on a small wood lathe. The upright post, or arm, of the microscope is made from pipe or tubing of 2" outside diameter, but this may be varied somewhat, depending on what is easily available, since this member's purpose is simply to provide a firm support for the microscope unit and slide stage.

If it is impossible to procure a fan pulley with a shaft hole of

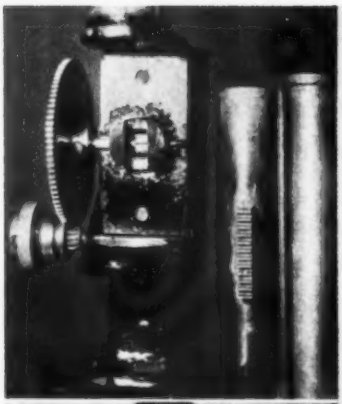


Follow details shown above. Microscope base is one side of a discarded automobile fan-belt pulley.

suitable size, the hole may be turned larger with a metal working lathe. Otherwise, the upright tube may be soldered to the pulley-base. Note that the pulley has one flange removed; this is a simple stunt, as many such pulleys are made up of two halves bolted together.

The slide stage is made from a pipe flange with the threaded neck removed by hacksawing. The flange then should be smoothed and polished with emery cloth. A slot hacksawed and filed in the upright tube takes the edge of the flange, which is soldered in place. Be careful to secure a right angle between flange and upright.

The unit that carries the telescoping tubes and the focusing mechanism is made from a section of auto frame, hacksawed to size. Holes are made for the body tube to pass through, as shown. (Body tube is large tube which has toothed rack soldered to it.) A good tool for cutting these holes in the absence of a lathe is a cylindrical saw such as that commonly used in radio panel work and on auto dashboards in body shops. The holes should allow for a snug sliding fit on the body tube. Cut them slightly undersize and file with a half-round file to proper fit. A notched rim of tin is soldered around the top hole, and its tabs bent slightly inward to keep the tube snug. Before cutting the holes, determine by test the proper location of their centers



At top is focusing unit with vernier. Slot for toothed rack is shown above.

Here is the camera attachment. Light source can be made from slide or movie projector and adequate ventilation for cooling.

so as to allow for the toothed rack and pinion that does the focusing job.

A cog from an old alarm clock or from a toy construction set makes a good pinion. If a toothed rack is not obtainable with pinion to fit, use a cog as mentioned, and make your own toothed rack. To do this, coat the tips of the cog teeth with printer's ink, Prussian blue, or paint, and roll it carefully along the surface of a square metal rod (such as a doorknob shaft) and then file notches where the paint marks are. Using a hacksaw and small file, a careful job here should produce excellent results. Cogs up to 3/8" outer diameter will be satisfactory. One inch is ample length for the toothed rack. Long nails or small diameter curtain rods make good shafts for the pinion.

If the pinion is to be operated directly, the shaft should extend from both sides of the frame section to take cast babbitt knobs on each end for focusing. With a pair of old phonograph gears or any similar ones, a vernier arrangement may be made for higher sensitivity as shown on the original.

A babbitt rim must be cast around the outside lower end of the smaller telescoping tube, or draw tube, and another around the inside rim of the upper end of the larger body tube. The latter rim is cast merely as a thin plug, then drilled and reamed to size. Both can be turned to size in a metal lathe, or even in a wood lathe, using a file. Coat the inside of the body tube with thin black lacquer before the final fitting of the rims.

A tin cover, carefully cut and bent, makes a snap fit over the auto frame section that forms the main body of the focusing unit. The actual bearing for the pinion shaft is made from a pipe plug. In addition to the

slot filed across its face, it will be necessary to bore a hole through the center of this at right angles to the shaft hole. This permits the pinion to be mounted nearer to the surface of the auto frame. If a large pinion is used the frame itself may be drilled for tooth clearance.

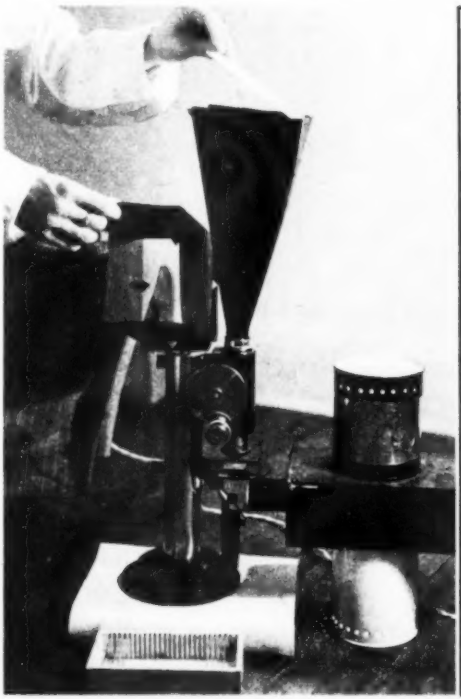
The entire focusing unit is mounted by bolts through the upright tube into the section of auto frame, which is threaded to receive them. Ordinary ¼" bolts of suitable length are good here, and may be matched to an inexpensive tap for the frame. Thick washers for spacing out from the upright may be made by sawing ½" slices from ¾" bolts or shafting, and drilling them. A little work with the half-round file will make them seat snugly on the upright. File them on the flat side to trim and bring the focusing unit parallel to the upright.

If low power lenses are to be used, wooden adapting plugs may be turned on the lathe for a plug fit into the tube ends. For higher power lenses babbitt plugs should be cast in and turned to fit the lens units to be used. In the event your lathe won't duplicate the fine threads on the lenses, a set screw may be run through the babbitt to hold them.

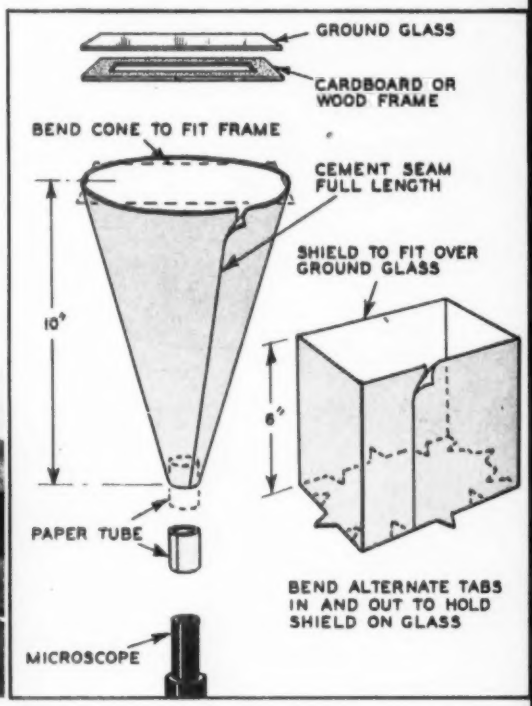
Generally speaking, low-power lenses will call for a somewhat shorter tube length than that shown. To permit a shorter body tube, a section of Ford Model-T frame may be used as the basis of the focusing unit.

A regular microscope mirror may be used, or you can make one from any small mirror. In either case it must be mounted as shown in the photos, on a small arm extending from the top of the base so that the mirror will be centered under the hole in the slide stage.

If high-power lenses are used, a suitable condenser should be mounted from the upright below the slide stage. It is worthy of note also that most high-power microscopes (around 1,000-1,500 power) have a fixed tube length. The tubes telescope merely to make the instrument more compact for the carrying case, etc. When pulled out to full length. these tubes measure about 60 to 70 millimeters between upper and lower lenses. Practically all standard high-power lenses, foreign or domestic, call for a tube length within these limits, [*Continued on page* 132]



Focusing is done with ground glass in viewer.

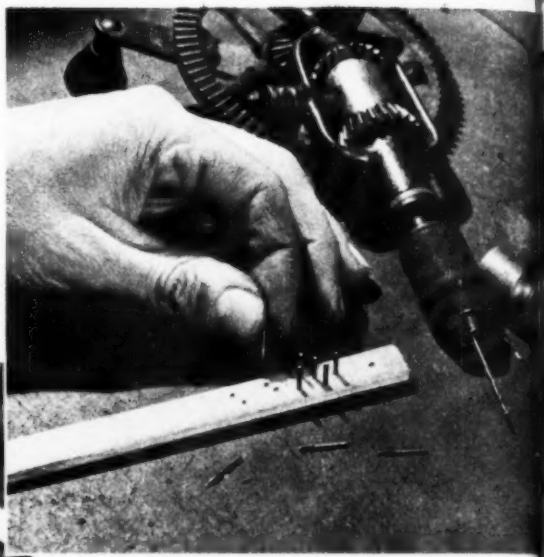


Make viewer of heavy, black paper or paint black.

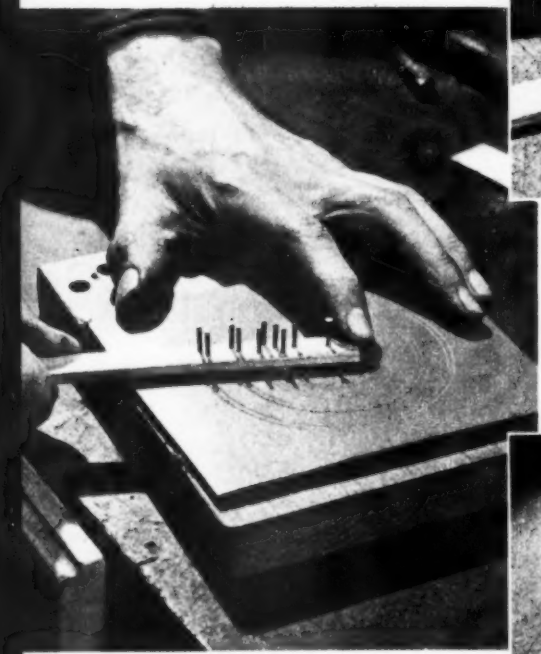
Print Your Own Targets

by Walter E. Burton

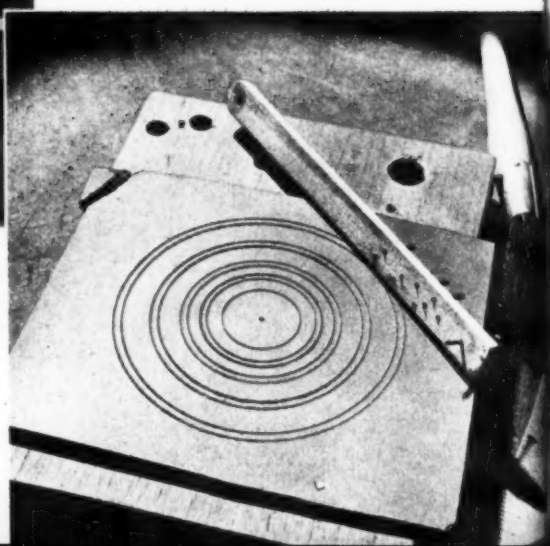
The linoleum must be converted into a printing block with a disk in the center and a number of concentric, raised circles. To mark off these circles, you will need a strip of wood and some old phonograph needles. Drill undersized holes to take them; points should protrude slightly.



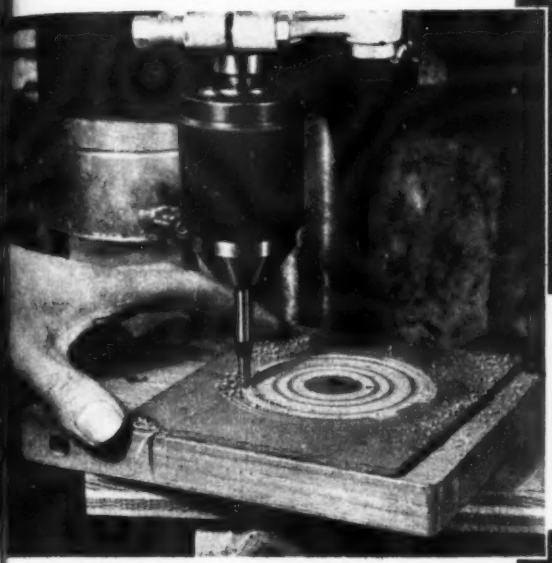
Obtain a piece of battleship or ordinary inlaid linoleum and fasten it to a piece of scrap wood with small nails near the corners. Use a nail as a pivot for the strip and swing the circles, letting the needles just scratch the surface of the linoleum. Don't try to cut with them, however.



This is the linoleum block after the grooves have been cut in its surface. Each needle point determines the boundary of a target ring; the ring should be about 1/16" in thickness, so space the needles on the strip accordingly. Tap the needles with hammer if deep scores are desired.



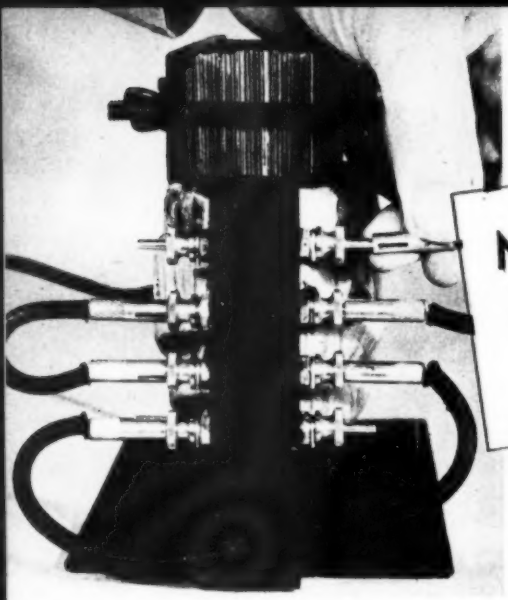
PAPER targets are inexpensive things, but you can't pick them up in every corner store! On the rifle range, morever, they disappear rapidly. With some printer's ink, paper and a linoleum block you can print your own with little effort.



With wood or linoleum carving tools, or a sharp-pointed knife, carefully hollow out the areas between the rings as above. Needle grooves serve as guide lines. If you have a drill press, you can cut away the linoleum with a router bit as at left. Run the bit fast and feed the work slowly.

Trim the block to a convenient size and hold down with small nails any part of the linoleum which tends to bulge, but don't drive down too firmly. Ink the block with a roller and black printer's ink. Use dab of ink to start; place it on a glass plate or enameled tray and spread with roller.

To print, lay a sheet of paper over the inked block, hold it with one hand and roll or press it into contact. If you lack a second roller, use a block faced with rubber, linoleum, or other resilient material, and a hammer or mallet to supply the force. Be sure paper makes complete contact.



Quick-change leads and coils are its secrets (left).

Multi-Voltage Transformer FOR THE HOME WORKSHOP

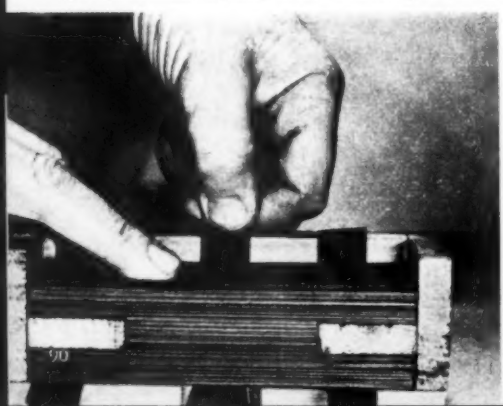
by Walter B. Ford

In your shop work, have you had occasion to use a voltage lower than your power supply? This transformer has 37 different step-down voltages to fill your needs.

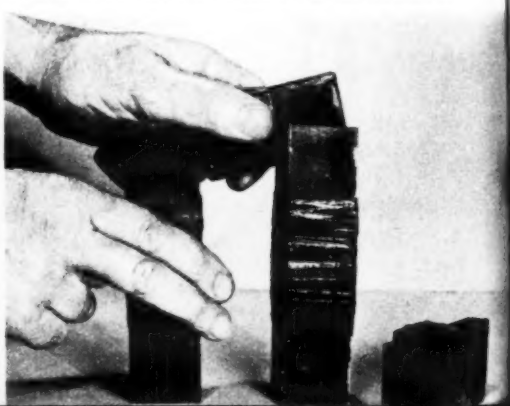
HAVE you ever wanted a particular voltage lower than that supplied by the light line and found it unavailable? This easily built transformer will supply an almost unlimited range of separate voltages without switches or taps, and with a minimum outlay for wire and other constructional materials. The number of separate voltages at the disposal of the builder will be limited only by the number of secondary coils he wishes to wind. For instance, with secondary coils wound for 3 volts, 4 volts, 6 volts, and 8 volts, the builder will have 18 separate voltages available. By adding only one more coil wound for 20 volts, the number of separate voltages will have increased by 19, making 37 voltages available by the use of only 5 secondary coils.

The secret of the transformer's usefulness lies in the application of a principle that is generally overlooked in small transformer construction. That principle is that when a current flows through two adjacent secondary coils in opposite directions, with these coils connected in series, the voltage available at the two terminals of the coils will be the difference of the voltages that would be set up in the coils when the current flows through them in the same direction. For example, when we connect the 3-volt coil and the 4-volt coil in series with the current flowing through each coil in the same direction, the total voltage available will be the sum of the individual coil voltages, or 7 volts. If we connect the two coils so that the current flowing in one coil is in the opposite direction to the current flowing in the other, the voltage available will be the difference of the individual voltages, or one volt. By means of quick-change leads and terminals, coil con-

Tape laminations together before removing the form.



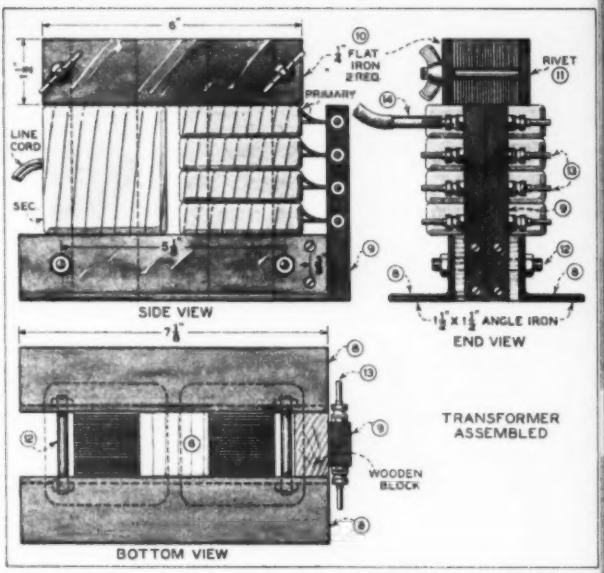
Sections of the core are assembled as shown below.



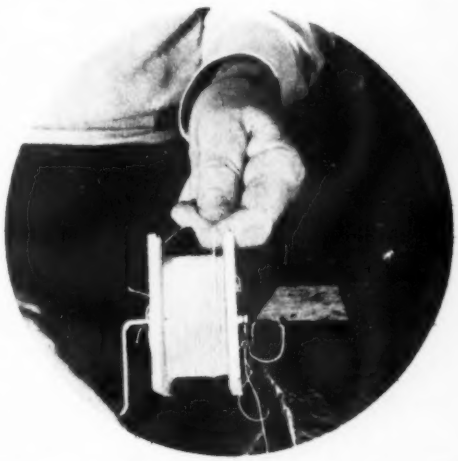
nections may be changed within a few seconds. When it is necessary to remove a coil from the transformer and replace it with another, the removable core section makes it possible to complete that operation within less than two minutes.

The transformer is designed for operation on 120 volts, 60 cycles, and has a conservative output rating of 100 watts. Since the output voltage requirements will vary with each individual builder, data for winding secondary coils with definite voltage output will not be given. Instead the builder may wind coils to meet his particular needs.

The first step in building the transformer is to cut the core laminations to the sizes shown at figures 1, 2, 3, and 4. The steel sheets for the laminations may be obtained from the salvage stock of power companies. If that is not obtainable, stove-pipe iron of 26 or 28 gauge may be substituted. Cut enough pieces of each size to make stacks as follows: Fig. 1, 1" high; Fig. 2, 2" high; Fig. 3, 1" high; Fig. 4, 2". Make two wood forms for forming the core sections, as shown at figure 5. One form should have an inside length of 4⅝" and the other form an inside length of 6". Cut four wood blocks, ½" thick, 1½" square, for holding core laminations in place before they are taped. The method of forming the core sections is shown at figure 5. Strips of friction tape are placed in the wood form to facilitate removing the laminations from the form. Wrap the tape around the wood blocks and the laminations, place the whole assembly in a vise and wrap the center section tightly with friction tape. The com-

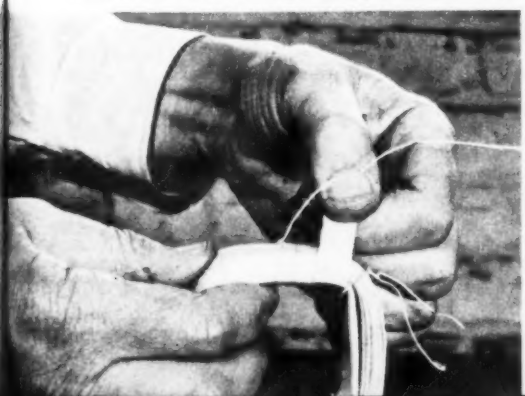


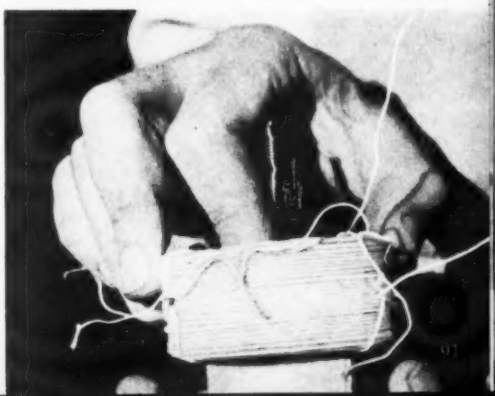
Assembly detail: numbers are referred to in text.

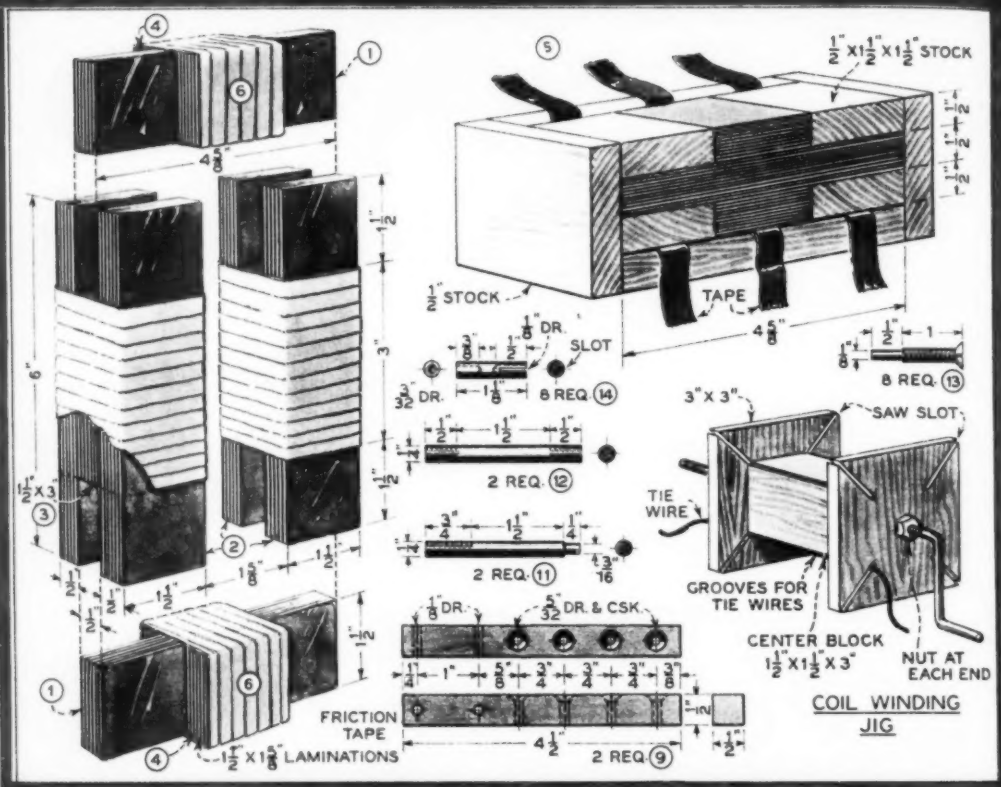


Winding with jig (above); removing wire coil (below).

Each coil should be wrapped firmly with cotton tape.







pleted core section is shown at figure 6. When assembling the core section which will be removable, paint each lamination with shellac or varnish as they are assembled. This will bind the laminations into a solid section. The longer sections of core then are assembled in a similar manner in the larger wood form, with the exception that only two wood blocks will be required. The wood blocks are placed in the form on top of a ½" stack of laminations, figure 2. The center laminations, figure 3, next are placed in the form between the wood blocks, followed by another stack of long laminations.

Assemble the core with a short section on the bottom and the two long sections in an upright position. Drill the two pieces of angle iron as shown on the side-view drawing. The holes for clamping the two pieces together should be ¼". Drill 5/32" holes in the ends of the angle irons to hold the wood block. Thread the ends of the ¼" round rods, figure 11, and clamp the angle irons to the core with hexagon nuts. Insert a wood block between the ends of the angle irons to hold the terminal strips in place, as shown on the side and end-view drawings.

Drill the wood terminal strips as shown at figure 9. Turn the ends of the 8-32 brass machine screws as shown at figure 13. Insert the machine screws in the wood terminal strips so that the heads of the screws rest in the countersunk holes. The heads of the screws should be below the surface of the wood strips so that they will not make contact with adjacent screw heads. Secure the wood terminal strips to the wood block and join the two strips together at the top with a wood screw.

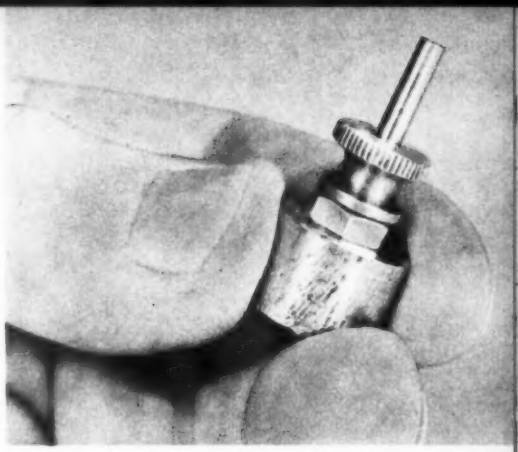
A winding jig for winding the primary coil is shown in the drawing. Jig consists of two square wood sides and a wood center block, held together with a threaded crank. Slots are provided in the sides and center block for the insertion of tie wires which will hold the completed coil together while it is being

removed from the jig. Before starting the winding of the primary coil, place a piece of scrap wire about 9" long in each slot. Wrap a piece of thin 3"x12" cardboard around the center block of the winding jig. Drill a $\frac{5}{16}$" hole in a piece of wood to serve as a support for the threaded end of the winding jig, place the coil support in a vise and wind 360 turns of No. 20 D. C. C. wire evenly on the jig over the cardboard center. Before starting the winding, allow an end of the wire about 6" long to extend through one of the slots in the side of the winding jig. Twist the ends of the tie wires together around the coil and remove the coil from the jig. Connect a piece of lamp cord to the two ends of the coil, solder and tape the connections, then tape the whole coil with cotton tape, in and out through the center of the coil and parallel with its length. Be sure to remove the tie wires when they are no longer needed.

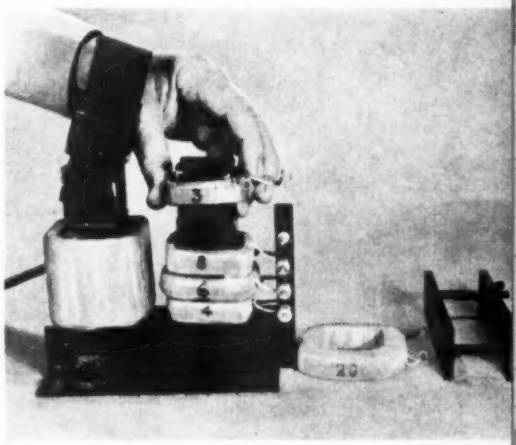
Dip completed coil in shellac or varnish and allow it to dry. The secondary coils are wound in a similar manner, with the exception that the center block of the winding jig should be only ¾" long. Since the builder will undoubtedly wish to select voltages best suited to his needs, no data for winding particular secondary coils will be given. By allowing 3.3 turns of wire for each volt that he requires, he may wind his coils accordingly. Each coil should be wound in the same direction and after each coil is completed, the starting end should be painted or marked to make identification easy. The size of wire used in the secondary coils will depend upon the amount of current required at the particular voltage for the finished coil.

Total current in amperes which will be available from any secondary coil may be found by dividing the wattage of the transformer, 100 watts, by the voltage of the secondary coil. For example, the total current available at 6 volts would be 16⅔ amperes, but there are few applications where that amount of current would be required. By allowing a cross-sectional area of 1,000 circular mils for each ampere of current required and referring to a wire table for the nearest corresponding size, the numerical size of the wire may be determined easily. Mark the voltage on each secondary coil to permit a quick selection.

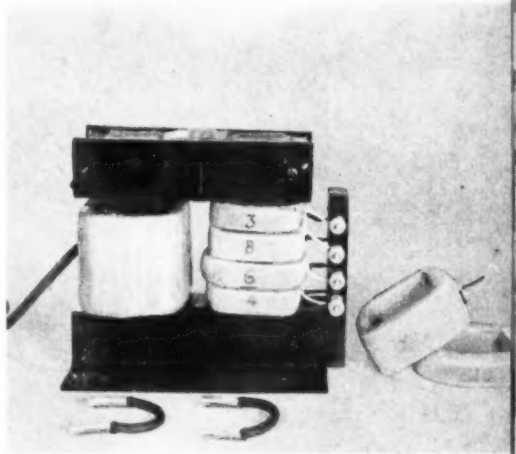
Drill the two pieces of band iron as indicated at figure 10. The holes in one piece should be [*Continued on page* 136]



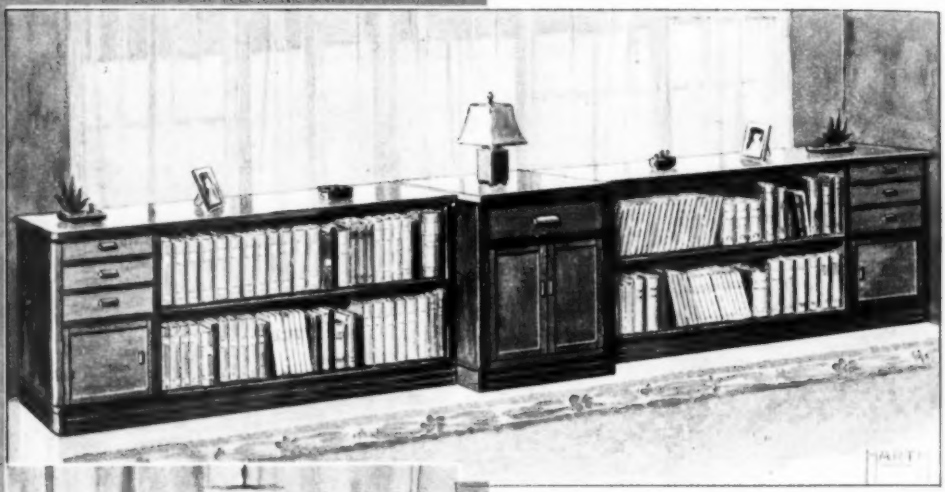
Make a jig for pins of the coil terminals as above.



Changing coils; their voltages are marked on sides.



Completed transformer with leads and extra coils.



The phonograph cabinet is attractive and useful.

FUNCTIONAL FURNITURE

by A. H. Smith

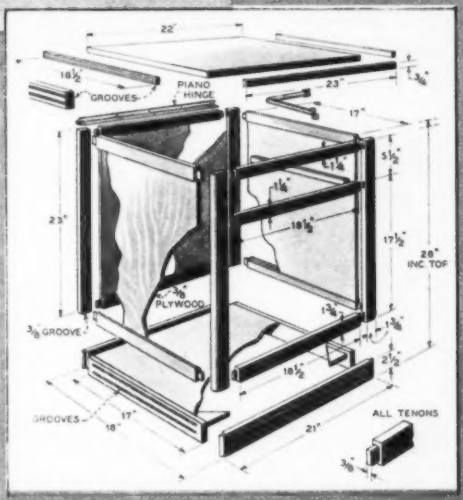
THE average home seldom has enough space for books, records and sheet music. There is the abundance of knick-knacks such as playing cards, unmounted snapshots, a camera and one thousand and two miscellaneous items which clutter up an otherwise orderly home. The reason, of course, is that these things are cumulative. The bookshelves are crammed, the new record album is the "last straw," the piano bench is full to overflowing, and music scores pile up atop the piano. Aunt Emma sends another bridge set including

Bottom compartment holds all your records.

Drop front provides access to control switches.

Phono cabinet is flanked by the bookshelf and music cabinets. This is left unit.

The details of record cabinet are below. Fiber board will do instead of plywood.



four decks of cards for Christmas. What to do?

Quantity production demands standardization, and while undoubtedly general purpose furniture is designed to fill the widest needs, it is practically impossible to select pieces which "fit." The only answer is to build it yourself.

Wall space is usually at a premium on account of windows, and so why not design the furniture to utilize the space below the windows. Here described and illustrated is an ensemble, easily built, which will accommodate dozens of your favorite books, your record albums, all the doodads which are scattered about the house, relieve that overburdened piano bench, and at the same time provide a home for that record changer or phonograph pickup

Record changer at lower left; hinged top shows below.

In the photo above is shown the interior of the music cabinet with shelves for sheet music. The bookshelf and music cabinet unit is in bottom photo.

which now stands so forlornly upon some table top. Here are six general purpose drawers, ten music shelves, approximately 14′ of bookshelves, and a good-sized record cabinet. Even the Better Half will approve of your spending evenings in your workshop for the next week or two when your purpose is as excellent as this one.

Dimensions and construction details are shown in the illustrations. Before starting construction, measure your window sill heights and make changes in dimensions so that the tops of the units will be flush or slightly below sill height. Changes also may be made in the length of the bookshelf units to fit individual conditions. It is not advisable to change the dimensions of the phono and record cabinet as its size will accommodate almost any commercial record changer or phono pickup. The cabinet also will accommodate the M.I. Record Changer described in RADIO MANUAL No. 3 and in the November, 1942, MECHANIX ILLUSTRATED.

The sketch shows the completed units placed as an ensemble at one end of the room. Photographs show closeups of the various features. The record feed shown was described and illustrated in the November, 1943, issue of MECHANIX ILLUSTRATED. The purpose of the drop front is to provide convenient access to the control switches for the record changer. Records can be rejected or the phono started or stopped without lifting the top of the cabinet, which need be used only when loading or unloading the changer.

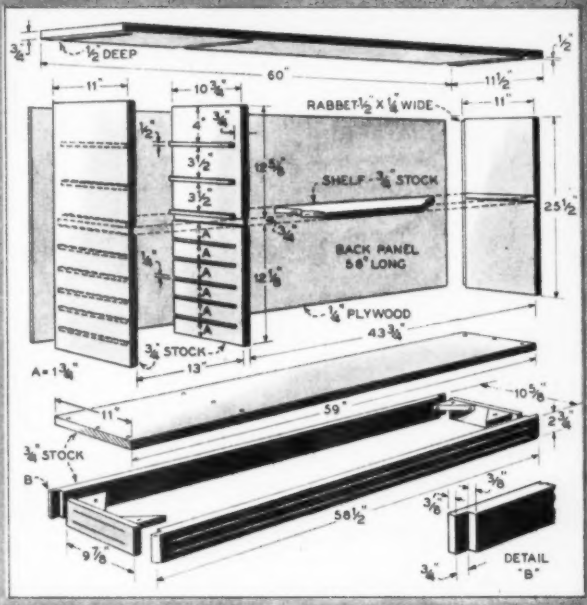
Most desirable woods are at present unavailable, but ¾″ and 7/16″ clear pine are generally obtainable in small quantities. It may be necessary to substitute fiber board for backs instead of ¼″ plywood, and also to use glued-up panels of narrower stock instead of plywood for the sides and top of the phono cabinet.

Before attempting to apply a finish, be sure the surface is silky smooth. An oil stain is recommended as it is easy to use and produces a very satisfactory finish. Oil stains are available in red or brown mahogany, various walnuts and maples. After applying do not permit the stain to dry fully as a muddy deposit will result. After drying for about one hour, the surplus should be wiped off. If a darker finish is desired, apply another coat and after a brief drying period, wipe again; repeat until the desired depth of finish is obtained. To maintain perfect smoothness, the piece now should be rubbed down with fine steel wool. There is no steel wool? Here's

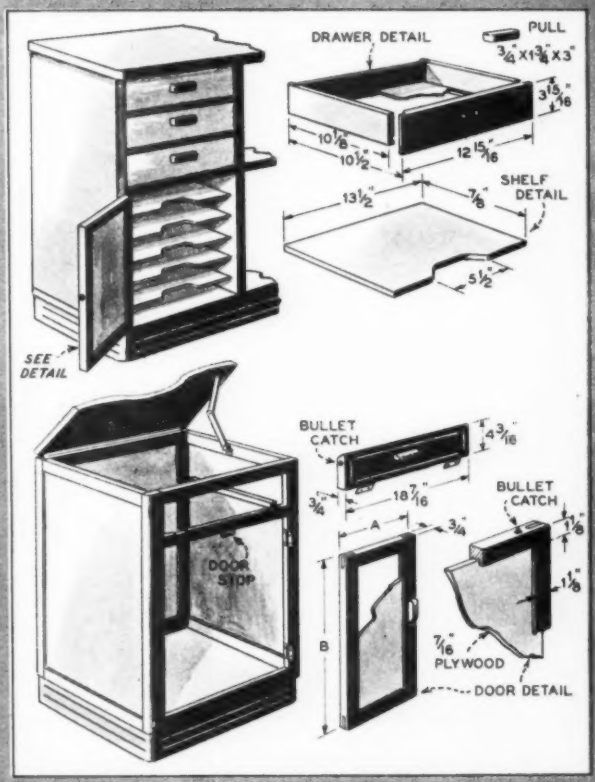
a little secret from one of the leading furniture manufacturers: get yourself a supply of very fine sandpaper, and take a small sheet and moisten it, not with water, but with saliva. It works. Crumple it gently, work it carefully back and forth, and you'll find it assuming a soft pliable quality which can be used much like a rag but has the practical efficiency of fine steel wool. Use this very lightly—don't scratch. After rubbing apply a very thin coat of shellac. (The Victory substitute is satisfactory.) When dry, rub to remove all traces of dust particles and regain the original smoothness. Apply a second wash coat of shellac and rub again. If necessary, apply a third wash coat and rub. Never apply shellac thick; thin it until it is practically the consistency of clear alcohol with just enough shellac to make a wash. After the final rub, give it a coat of wax. This sounds like tedious work and it is, but the result is worth-while and will result in furniture which will make a pleasing as well as useful addition to your living room or music room.

For a modern living room, it may be desirable to finish the pieces in lacquer. An attractive effect can be obtained by painting the outside surface one solid color and the inside compartments a contrasting color, first using a wood filler if the wood is open grained.

The doors of the record and music compartments can be kept closed by means of simple friction catches. These are very efficient in spite of their small cost, and can be obtained at almost any hardware store. One of the things to watch for is the hang of the doors which depends, among other things, upon the installation of the hinges. There are quite a few invisible types of the latter on the market, and they will serve excellently.



Diagrams show details of bookshelf and cabinets.



Varied shapes of thrown and cast pieces. You can make them all and many more with practice.

The Potter's Art

by R. H. Jenkins

Throwing and turning is the heart of pottery making. Here's how to do it, told by an expert in the art.

PART II

LAST month we described the various preliminary preparations necessary before actually making pottery. Mixing and wedging of clay, construction of wedging table and potter's wheel were gone into in some detail, and you should now be ready for the thrill of turning your first piece of pottery. (If you missed last month's installment, better get a copy of July MI and read it before going any further.)

We'll assume, however, that you have everything set up, the clay wedged and ready to be thrown upon the wheel. We'll start at that point and take up the throwing and turning process in step-by-step manner, for the sake of clarity and readability.

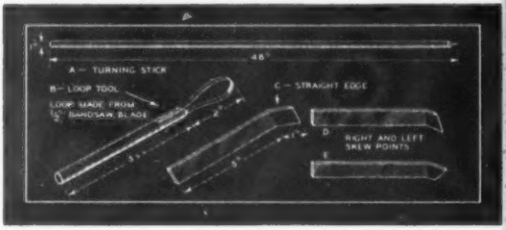
Step One: Take your place at the wheel and practice running the machine (as to which foot you kick with will depend upon the hook-

After centering the clay on the wheel it is drawn up.

Starting hole with the thumb in exact center of clay.

Hole being enlarged with right hand inside, left outside.

Walls are thickened a bit to improve consistency. Below is a set of turning tools you will need to make.



up of the machine). Run the wheel slowly counter-clockwise. Take a lump of clay the size of an indoor baseball and throw it forcibly upon the wheel head. Moisten both hands, press down with the right and push toward the center with the left. This will fasten the clay to the wheel and at the same time start centering it. Now push with the left hand and pull with the right so as to draw the mass into the exact center of the wheel. Bring the palm of the right upon the top of the ball of clay so as to form a dome. Keep on turning until the dome is centered perfectly. If the clay is not well-centered the next steps will fail.

Step Two, Drawing Up: With the mound of clay centered it must be worked up and down in order to force all of the air pockets from the mass. Using the lower part of the palm of each hand, and pressing in evenly from the bottom, slowly raise the hands to the very top so that the drawing up will be true. Be sure that the clay makes a complete revolution at each new move upward and hold the position at the top until the whole cylinder runs true. Now press down upon the top

Clay is raised, walls thinned out, cylinder formed.

Pottery is shaped, ready for truing and ribbing.

with the right hand and guide the column with the left until the clay is once more in a perfect dome shape on the head of the wheel. Repeat this process of drawing up and pressing down until the whole ball is of even consistency. You are now ready for the next step.

Step Three, Making the Center Hole: A hole must now be made in the center of the mound. With the thumb of the right hand spin a hole in the center, going down to within one inch of the wheel head. With the left hand pushing steadily from the outside, place two fingers of the right hand in the hole and pull out on the clay. By letting the left hand give way lightly, and the right pull evenly, the hole will be enlarged and still be kept in the center of the mound. Place more fingers in the hole and pull outward, holding firm this time with the left, so that the clay will be forced evenly through the hands. This insures a careful centering of the hole. Practice these steps until they are well mastered. At all times use plenty of water on the hands.

Step Four, Making the Cylinder: Regardless of the final shape of the pottery, a cylinder must first be made to get the thickness of the walls. There are *two methods* of doing this. The first and easiest is to place the palm of the left hand against the outside of the mound and the fingers of the right on the inside with the thumb of the right resting against the back of the left. Press now from the outside, using the lower part of the palm of the left hand, and holding from within with the fingers of the right. Keep the pressure points opposite each other and slowly and steadily raise the hands. Keep this steady movement upward until the top is reached, and then hold the position until all is true. Be sure the hands have reached the top, and when taking them away, separate them so as not to draw up one edge higher than the other. If the cylinder is tall the pressure will have to be gradually lessened as the top is reached in order to keep from twisting it. Repeat the process until the walls of the piece are not more than ½″ thick.

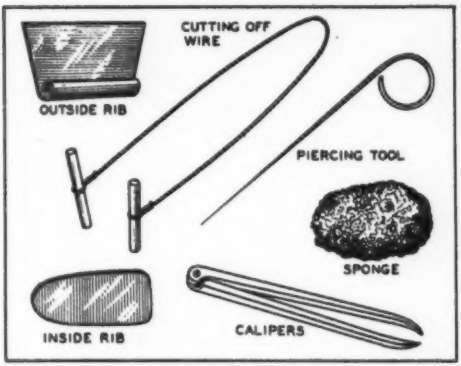
This is the most difficult step in throwing, so the beginner must not be discouraged. Remember to press from the outside and hold from within. It won't hurt if the form is slightly conical. It is much easier to expand a shape than it is to compress it, especially in the beginning. If, however, the piece needs to be reduced in diameter, place the hands in the same position as in step one and go through the same process. This will thicken the walls but will reduce the cylinder to a smaller circumference. The walls can again be drawn up as in the beginning.

In the second method of drawing up the cylinder, place the tips of the fingers of the left hand on the inside of the mound, and the index finger of the right hand on the outside, with the thumb of the right hand tucked back in the palm of the right. With the thumb of the left resting on the back of the right hand

Final shaping, ribbing and trimming is done next, after which the formed clay may be removed from the wheel.

as a steady, and the knuckle and fore-part of the index finger of the right pressing against the clay, hold with the tips of the fingers of the left on the inside, and slowly raise the hands. This process gives the worker a very definite point of contact and is especially helpful in finishing off edges. It is also not difficult to do until the piece becomes so deep that it is not practical to use the thumb of the left hand as a steady rest against the outside of the right. At such a point a great deal of practice will be needed to hold the hands directly opposite. The process should be mastered, however, for it does aid a great deal in making small and delicate shapes.

Step Five, Truing and Ribbing: Before making the final shape it is well to true up the edges and rib off the outside. A knife is held in the right hand, and steadying with the left, the point fed into the clay at the top until a small ring is cut off. This will make a perfectly straight edge if there are any irregularities. Many times this will not have to be done because the throwing will be true in itself, especially as the would-be potter gains practice and experience. It probably will be well, however, to trim the edges at first and also to use a rib, at least on the outside. The term "rib" probably came from the fact that our ancestors actually used a rib from some small animal for the job. A piece of tin or galvanized iron will do for the work here. Hold the rib with the right hand and steady from the inside with the left. By pressing gently from the outside the piece can be scraped perfectly smooth. The trimming of the top, and the truing up of the outside with the rib can be left until the piece is formed into its final shape if the worker desires, as was done in the illustrations. It sometimes helps to use these tools both before and after shaping.



This group of simple tools is needed for throwing.

Step Six, Shaping: For the beginning shape it will be well to stick to the more simple forms, such as bowls, leaving complicated shapes until later on. With the palm of the left hand on the outside near the bottom, and with the fingers of the right on the inside, press out from the inside holding gently with the left. Slowly raise the hands, and as the raising goes on, [*Continued on page* 138]

Left: Testing with a pencil for centering in turning. Right: Final step before firing: turning off bottom.

LAYOUT FOR MACHINING

by Josephine von Miklos

Miss von Miklos is one of America's leading women machinists, and her hints and advice on shop practice, which appear each month in MECHANIX ILLUSTRATED, should be taken to heart by every workshop fan who takes pride in his skill and in the precision of his finished projects.

EQUALLY as important as correct setups and machining methods in workshop technique is correct layout. It is the basis of design; and if done carefully and with forethought, it will save much time and material—important items today when time is at a premium and every half-inch of material counts.

If you want to build a special jig or tool, it is a good idea to figure the thing out on paper first. When you have all your measurements down, make a drawing of all sides of the object. Then select a piece of material which comes nearest to the all-over size required, put it on a flat surface, check it for squareness, apply whatever medium you need to enable you to make a mark with your tools, and proceed. As soon as one side is marked, check it carefully before you go on to the next side or piece, and remember that it is important to keep the piece clean, since small particles of dust or grit may throw off your measurements. Wipe the tools carefully after each application, particularly the scales and scribers; the smallest burr may throw them off.

Layout ink is applied to the work resting on plate (above). With square held on top of the piece, scriber is used to scratch a line in the ink (below).

Another good point to remember is that measurements should never be taken from a blueprint or drawing. No matter how accurate the draftsman, paper shrinks, warps, and buckles, and often a blueprint will be "out" quite a bit for these reasons. Take your measurements from specifications only! Also, don't try to measure distance with just a scale; even the best scale may be somewhat marred at the end. Take your sizes from the scale with a pair of calipers and transpose them to the material, and then you can check again with the scale, or, better still, with a second scale.

The importance of all of this depends, of course, on how accurate your job really must be. If sizes don't matter, you can just mark the pieces any old way. If you want to have the final piece fit, however, accuracy in layout is imperative. When you figure your sizes, remember that cutting tools leave burrs and that sandpapering and polishing will take something off, also.

Here is a list of tools and accessories needed for good layout work:

Layout plate: There are several of these on the market and they come in a variety of sizes; 9"x12" is adequate for a small shop. Ground glass, cold rolled steel and duralumin are the materials used.

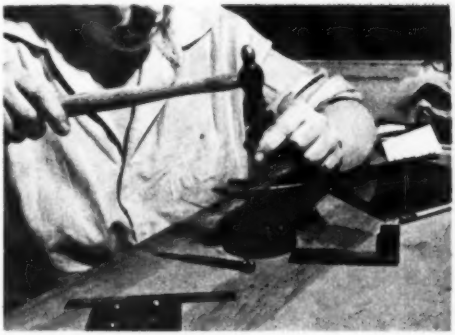
Layout ink: Usually blue; comes in cans with brush in screw top. Use on metals only.

Scriber rule: Should be a 6" precision steel rule, tempered and reading down to 1/64". An additional rule of ¼" width is helpful.

Square: This should be a toolmaker's square, ground and hardened. For less exacting needs, use a regular drafting square or carpenter's square. [*Continued on page* 132]

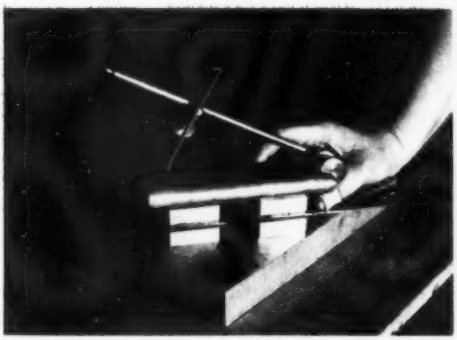
To insure accuracy, it is a good idea to check the square again before carrying lines to the next side.

When working on plastic, adhesive paper takes the pencil marks. Tolerances are larger than in metals.

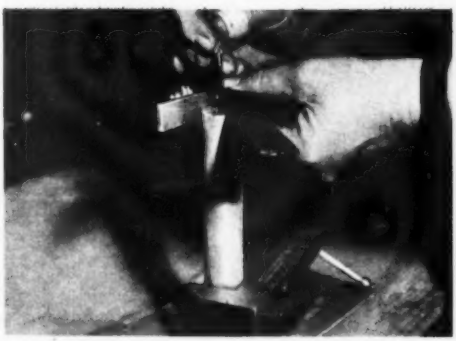


Using a small anvil, hole marks are punched in a small piece of brass which has been marked with scriber.

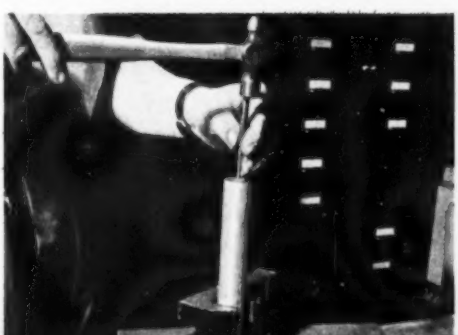
After center point of a hole has been marked and punched, outline the hole size with a pair of dividers.



Using surface gauge to make a straight line in the center of rod (above). Punching the center hole is shown below. Note how rod sits in the drill vise.

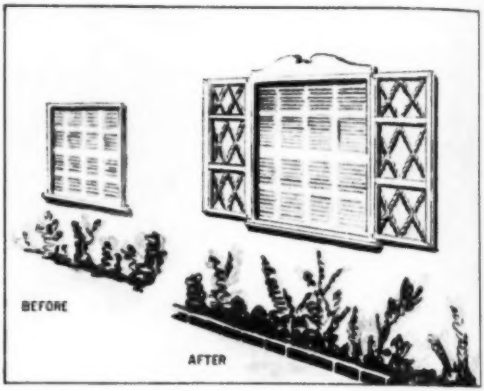


Rod center is found by marking two lines with scriber (above). Center hole is made by center drill of drill press with rod still in its vise (below).



With a little effort and careful planning, you can give your house an extra portion of attractiveness with decorative windows.

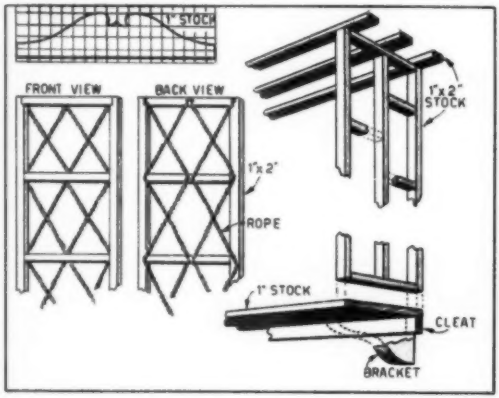
Lattice work or rope shutters improve a small window.



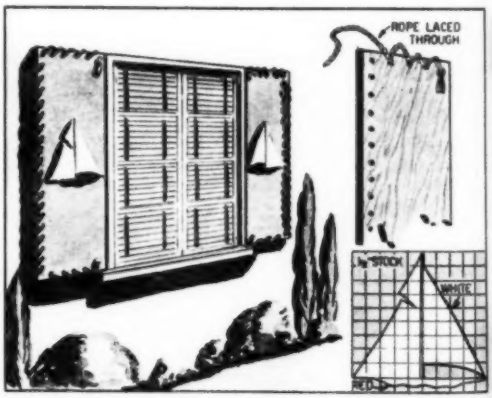
Dress up your Windows

by Roberta L. Fairall

HERE are two suggestions for the house or cabin by the seashore or lakeshore. Two plain boards of 1" stock, each half as wide as the window, have evenly spaced holes drilled on the top, outside, and bottom about 1½" from the edge with rope laced through and knotted at each end leaving a tassel; then the sailboat shown in the squared drawing is traced to ½" stock, jigsawed out, and nailed to these imitation shutters. The shutters are then nailed on each side of the window, stained, and the boat painted red with white sails. Another way to use rope in decoration is to make two frames from 1"x2" stock—



Construction diagram for arrangements at top of page.



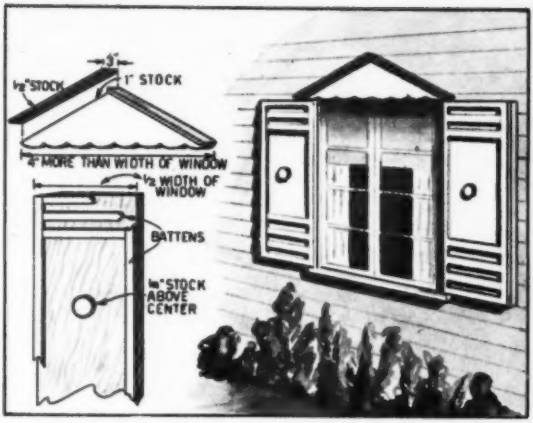
Painted sailboats on laced shutters are attractive.

joints rabbeted—each half the size of the window. Two cross pieces are nailed in each frame; then rope is crisscrossed and nailed to the back. The frames are nailed on each side of the window and suggest shutters. A decorative head casing then is cut from 1" stock and nailed over the window.

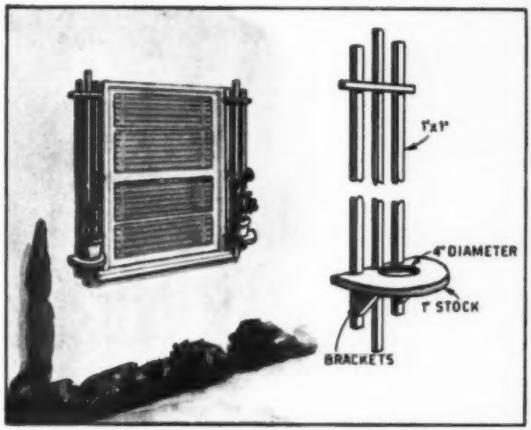
To accentuate a window which appears too small, an imitation roof is made easily. A triangle is cut from 1" stock 4" wider than the width of the window and scalloped along the bottom, two ½"x3" boards are nailed to the top flush with the scalloped section at the back and this head piece is nailed over the window. Two shutters are cut from 1" stock and battens nailed on for decoration.

A trellis and flowerpot stand at each side of a window is a welcome variance from the usual shelf under the window. Three lengths of 1"x1" stock, two the length of the window and one a little longer, are fastened together at the top with a cross piece of the same material and nailed into notches in the shelf at the bottom. A 4" hole is cut in the shelf so the flowerpot may be set securely into it. Two triangular brackets support the shelf.

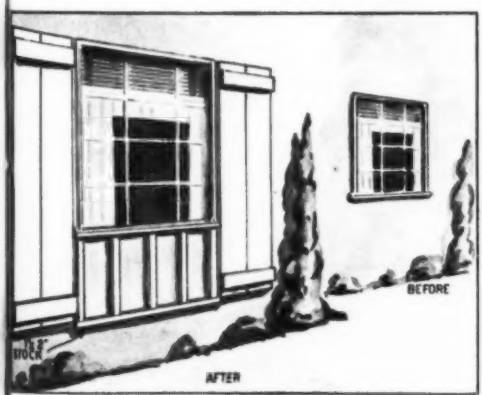
To give added importance and size, a window is lengthened in appearance by nailing five lengths of 1"x2" strips in a vertical position below the window and one horizontally at the bottom of these to suggest a balustrade; then shutters cut as long as the window and the decorative strips together are nailed on either side of the window. The shutters are each constructed from two boards [*Continued on page* 136]



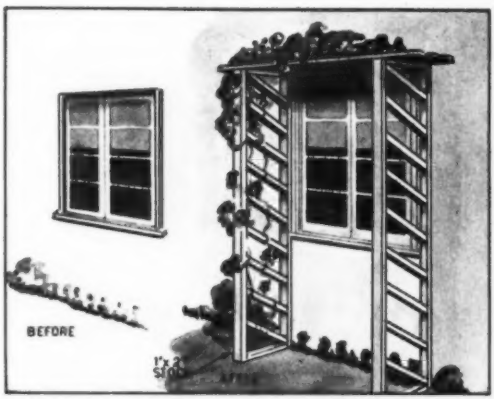
Imitation roof will accentuate a very small window.



Trellis and flowerpots at each side will add width.



Lengthen a window by nailing vertical strips below.



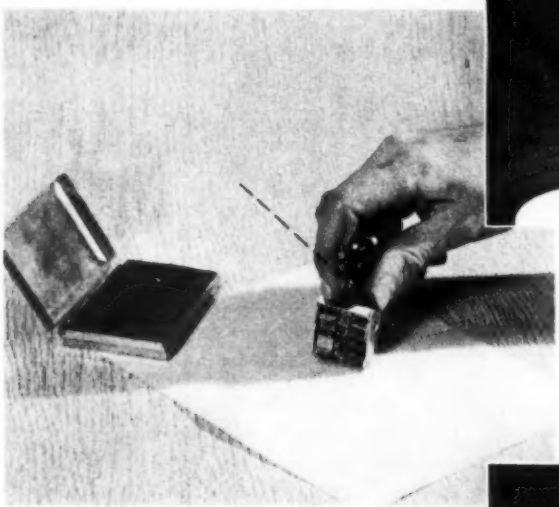
Lattice with diagonal slats help casement window.

Index For Spices

IF SPACE is at a premium in your cupboard, an index for your spice cans will prove a convenience and a time-saver. Labels can be made from gummed index tabs obtainable at the stationery store.

Cleaning Small Articles

A FRUIT jar is handy when dry-cleaning neckties, gloves, ribbons and other small articles. Put the cleaning fluid and the article in the jar, screw the lid on tightly and shake well. This method saves fluid.

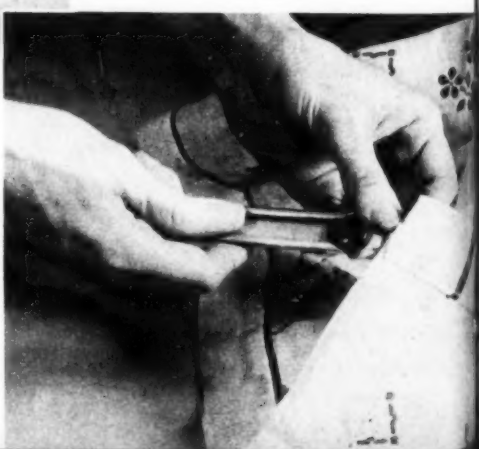


Stamp Guide

TO MAKE sure you are holding a rubber stamp right side up, drive one or two small nails or escutcheon pins in the handle on the top side for markers.

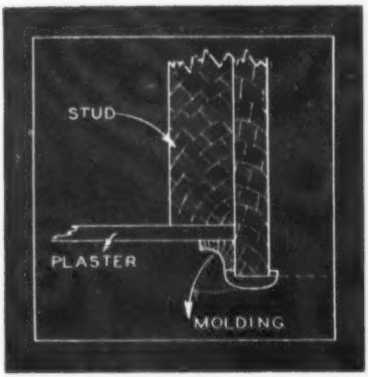
For Curtain Rods

THE irregular end of a flat, metal curtain rod makes it difficult to run the rod through the hem of the curtain. A round button, fitted in the end as shown, will solve the problem very nicely and will make it glide through without catching.



Recessed Shelves

FILL in blank wall space with bookshelves between the studs. Locate studs by tapping the wall, and then cut away plaster close to inner edge. Make of ¾" material with plywood for back.

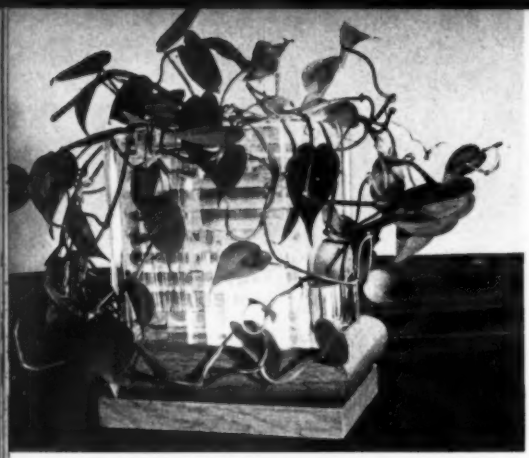


Dowel Dish Mat

DOWELS and a jigsawed rim are used to make this attractive hot dish mat. From ¾" walnut cut a 9" rim with an inside diameter of 7". Set the jigsaw at 12° and from this rim cut a ring ¼" on the top edge and approximately ⅜" on the bottom edge. Now split this ring in three sections and then glue them together with the grain of the center section running opposite to that of the other two sections, to make a strong rim.

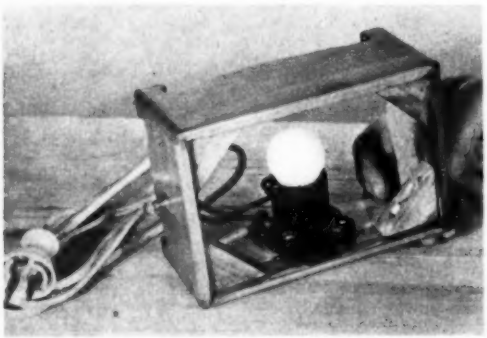
Drill 10 equally spaced holes through the inner rim for ⅜" dowels. The dowels, cut to 3¾" lengths, are slightly singed over a gas stove or other flame and glued in place leaving a 1⅜" space in the center.

Raise the outside rim until it fits tightly against the inner rim, then glue to keep in position and shellac.—*Benj. Neilson.*



Half-round oak molding and oak board made this base.

Here is another attractive design built of scrap wood.



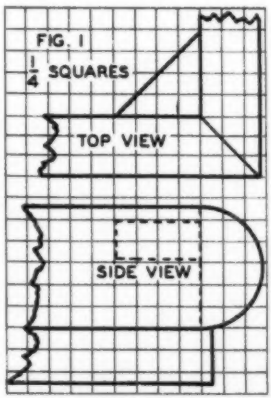
Socket and small bulb can be hidden in the base frame.

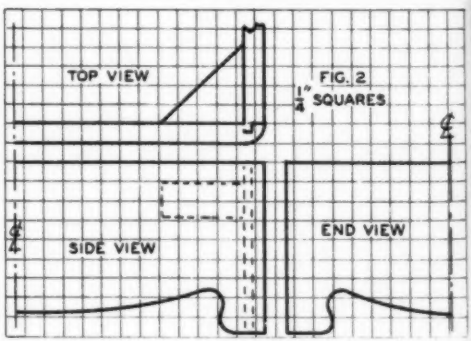
Novel NIGHT LIGHT

A COMBINATION flower holder and night light is not only decorative but very practical. It can be made from a few scraps of wood and a glass block which can be purchased for about $1.00 in any department store. The socket and low-powered bulb are concealed in the base, and just enough light is furnished to prevent a stumble over a misplaced piece of furniture or a forgotten toy. It is just right for the sickroom, too.

The wooden base is a topless, bottomless box or frame and the light it conceals shines up through the bottom of the glass block and through the water it contains. The bulb produces so little heat that the open corrugations in the surface of the block are ample to allow circulation of air, making it unnecessary to cut special vents. A switch can be placed in the base side.

Dimensions will depend upon size of the glass block.





by Charles & Bertram Brownold

THE SCHOOL SHOP

Conducted by Gilbert Poust

Lieutenant, Civil Air Patrol, Westchester Squadron

Chapter 18—The Aircraft Power Plant

ONE of the miracles of our age is the gasoline engine. Not many of us are aware of this fact because we have come to take its presence for granted. We know that there's one under the hood of our auto, and that we have to feed it gasoline and oil at regular intervals to keep it going. And that every so often the mechanic cleans from it a mysterious substance called "carbon," and performs an equally mysterious operation called "grinding the valves." But there our knowledge ends. We do not appreciate the complicated yet precision mechanism which years of engineering research has produced to supply us with concentrated power for our transportation on land and sea and through the air.

Perhaps a working knowledge of the principles of the internal combustion engine isn't necessary to make a good automobile driver, but it's a different story for the good pilot. When he's in the air, his power plant is his best friend and he's completely dependent upon it for the safe completion of his journey.

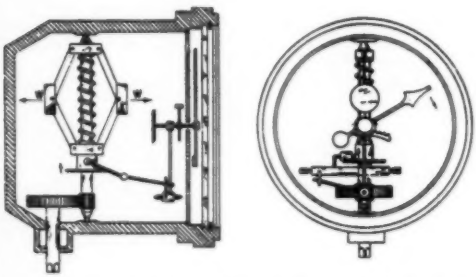
The engine is the pilot's best friend. An understanding of its principles will help him avoid trouble.

He must know its likes and dislikes, be alert for symptoms which might forecast trouble and be quick to supply the remedy. Let's consider a simple gasoline engine and see what makes it tick.

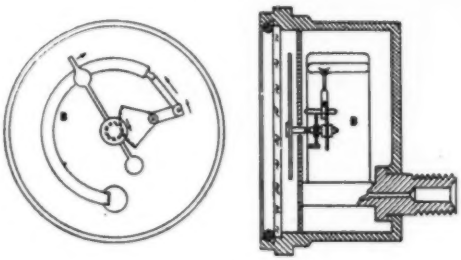
In the first place, every gas engine is made up of a series of cylinders. The number varies from 4 on the average light-plane engine to 24 or more on the big jobs. These may be arranged one behind the other as in the "straight 8" type of auto engine more commonly called *in-line*, in two banks lying flat and opposite each other as in the Lycoming or Franklin aircraft engine (called *opposed*), in *V-type* with two banks of cylinders arranged in the shape of the letter V, as in the Ranger or Allison engines, or in *radial* design as in the Wright engines.

Each cylinder is a power unit in itself. It is sealed at one end by a *cylinder head* and contains a plunger or *piston* which moves back and forth through it. The piston forms a tight fit in the cylinder. This is accomplished by *piston rings* which fit in grooves around the piston and expand against the cylinder wall. Some rings also aid in lubrication by carrying oil. The bottom of the piston is connected by a *piston pin* or *wrist pin* to one end of a *connecting rod*, the other end of which is attached to the *crankshaft* by a *crank pin*. The front of the crankshaft fastens to the propeller. As the piston moves back and forth in the cylinder, the crankshaft end of the connecting rod describes a circle, thus turning the crankshaft. This arrangement, then, transforms the linear motion of the piston into a circular motion of the crankshaft and the propeller.

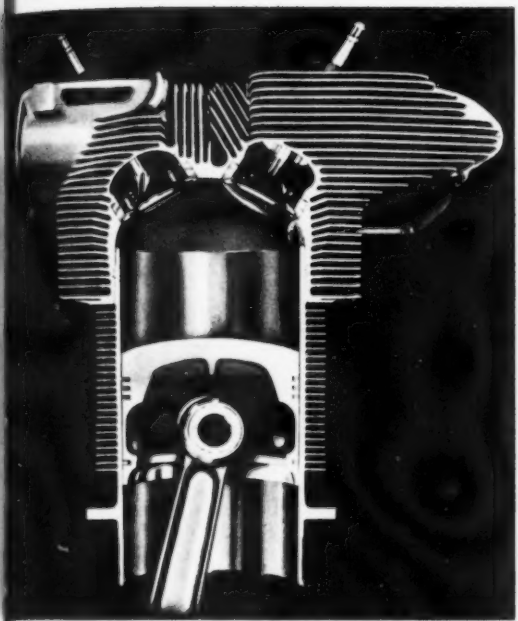
In the cylinder head are the spark plugs for ignition and two valves, *intake* and *exhaust*, which open and close the intake and exhaust openings or *ports*. The valves are operated by a separate shaft which is parallel to the crankshaft and is called a *camshaft*. (A *cam ring* is used on radial engines.) On this shaft are *cams*, one for each valve. The camshaft is driven by the crankshaft and turns one-half as fast. Extending from each cam to the top of the cylinder is a *push rod* which actuates a *rocker arm* connected to the valve. As the camshaft turns, the push rod is raised by the high side of the cam and raises,

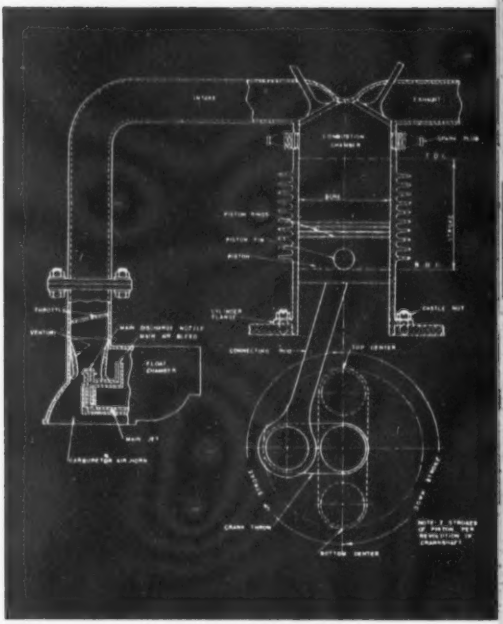


The tachometer measures r.p.m. Revolving shaft causes weights (W) to fly out, moving hand on dial.



Oil pressure gauge measures pressure of lubricating oil. Pressure causes Bourdon tube (B) to straighten.





The piston, on its down stroke, draws in air through the air horn and past the carburetor where it picks up gasoline vapor. This mixture continues through the intake manifold, past the intake valve into the cylinder.

in turn, one side of the rocker arm, depressing the other side which pushes open the valve against a heavy coil spring. When the push rod falls to the level side of the cam, this spring pulls the valve closed. Valve timing depends upon the position of the cams.

Now we have a clear enough picture of the engine to learn a little about the combustion process. The aircraft engine operates on the *Otto* or *4-stroke cycle* (incorrectly called 4-cycle). This means that there are 4 strokes (2 up and 2 down motions) of the piston to one *cycle of combustion*. They are:

1. Intake: (down) The exhaust valve remains closed, the camshaft opens the intake valve, and the crankshaft pulls the piston downward, drawing the gasoline mixture into the cylinder.

2. Compression: (up) Both valves remain closed and the crankshaft forces the piston upward, compressing the mixture.

Just before the piston reaches its top position, the spark occurs which ignites the mixture, then:

3. Power: (down) Both valves still are closed and the expanding gases of combustion force the piston downward, turning the crankshaft.

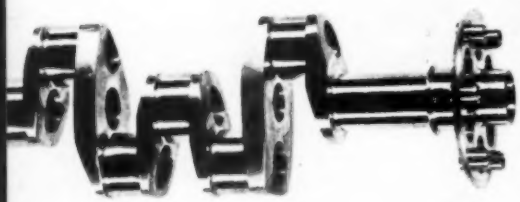
4. Exhaust: (up) The intake valve remains closed, the camshaft opens the exhaust valve, and the crankshaft pushes the piston upward, driving the burned gases out the exhaust port.

Then the cycle starts all over again.

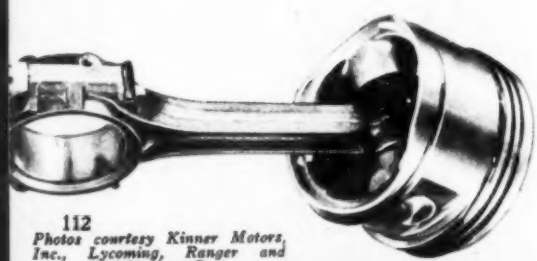
The fuel system of an aircraft engine is not too difficult to understand. Let's examine a very simple one. Gasoline flows from the fuel tank by *gravity feed* (pull of gravity), or is forced by a pump, through a filter and then to the carburetor. This device is essentially nothing more than a metering instrument which measures out the correct proportion of fuel to be supplied to the engine. It consists of a bowl containing a float which rides on the surface of the gasoline in the bowl. When floating at the correct height, the float closes a needle valve which prevents more fuel from entering the bowl. From the carburetor the fuel flows to a *jet* which is located in the center of the *intake manifold* through which

Here is a blow-apart photo of a 5-cyl. radial. Connecting rods of 4-cyls. fasten to the master rod.

Crankshaft for 4-cyl. Lycoming. Prop fastens at left.



Piston and connecting rod assembly. Note piston rings.



Photos courtesy Kinner Motors, Inc., Lycoming, Ranger and Wright Aero Corp.

the mixture is drawn to the cylinders. When the piston moves down on the intake stroke, it creates a suction in the intake manifold which draws in air through the air horn and past the carburetor jet. This air draws a fine gasoline spray from the jet and the resulting mixture of gasoline and air continues to the cylinder. As gasoline leaves the jet, the level in the carburetor bowl is lowered and the float drops, opening the valve to the fuel supply and allowing the bowl to refill.

A *butterfly valve*, resembling a damper in a stove pipe, is situated in the intake manifold on the engine side of the carburetor and is called the *throttle valve*. When the pilot opens this valve, there is no obstruction to air flow past the jet and to the cylinders and the engine runs at maximum speed. As the throttle valve is shut, however, it becomes increasingly difficult for the engine to "breathe" and it slows down. An important point to remember concerning fuel systems is the fact that fuel tanks and carburetors must have vents, holes by which air can enter or leave as the fuel level changes. If these vents should become clogged, engine trouble will develop.

The mixture burned in the cylinders must have a definite ratio of gasoline to air. This is approximately 15 or 16 to 1, which means 15 or 16 parts of air to one part of gasoline by weight. When more gasoline than this is present (for example: a ratio of 14 to 1), the mixture is said to be *rich*, and excess fuel is consumed by the engine and power is lost. When less gasoline is present (for example: a ratio of 17 to 1), the mixture is *lean* and overheating of the engine and backfiring is the result. Mixture is determined by the size of the jet opening, but on elaborate carburetors the pilot can adjust his mixture for altitude, maximum power, etc., from the instrument panel while in flight.

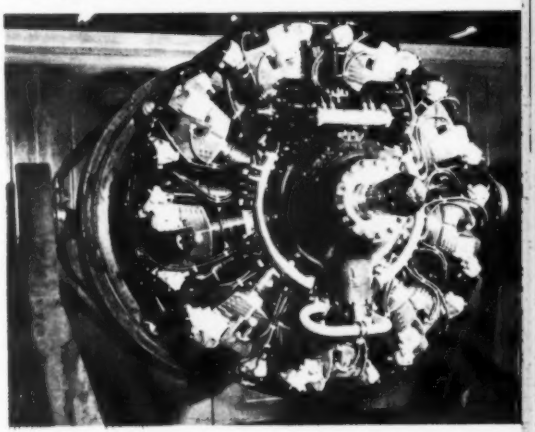
Just where the carburetor jet is centered in the intake manifold, there is a constriction or narrowing of the passage called a *venturi*. Its purpose is to speed up the air flow past the jet and to reduce the air pressure to bring about more efficient vaporization of the fuel. We learned in meteorology that when air expands and its pressure is reduced, its temperature also drops. This factor is the direct cause of carburetor icing. Even when the plane is flying on a clear, sunny day, this lowered

The 4-cyl. Lycoming opposed is a light-plane engine.

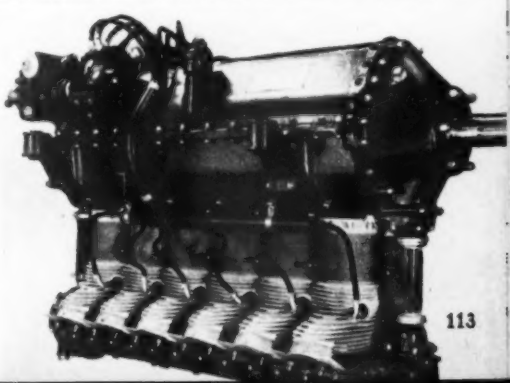
temperature at the venturi can cause condensation of moisture which will freeze at temperatures below 34° F. and form ice, clogging the passage. The effect on the engine is a gradual decrease in r.p.m. as more and more ice forms, with engine failure as the final result. Sometimes this ice can be removed by leaning out the mixture (if your carburetor has a mixture control) until the engine backfires; this throws the heat of combustion back through the intake manifold, loosening the ice. In any case, the carburetor heat should be turned on immediately at the first suggestion of icing.

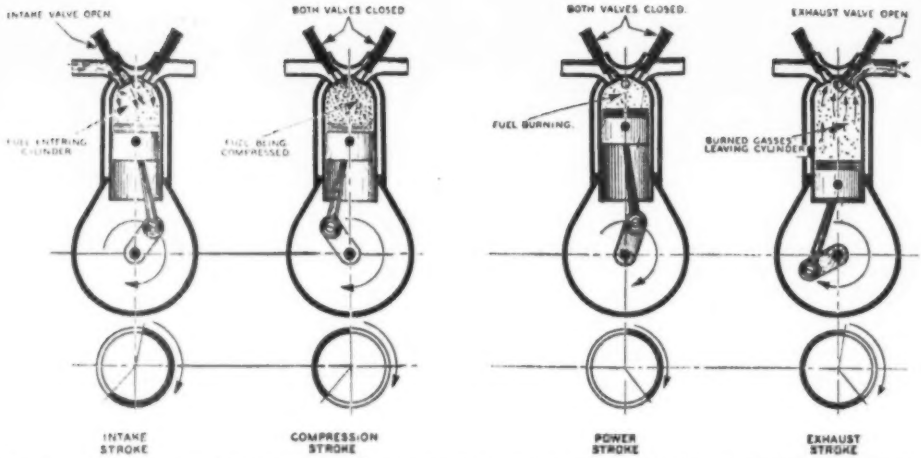
Each aircraft engine is designed to burn a particular quality of gasoline. In your auto, you can burn low-test or high-test with no apparent ill effect on your engine, but not so with your plane. Be sure to feed it only the grade of gas stated in the engine manual, or stamped on or near the fuel cap of the plane. Gas quality is measured in *octane* values, which are, in reality, measures of its anti-knock characteristics. We don't worry too much about a knocking auto engine, but a knocking aircraft engine means dangerous overheating.

The *magneto* is the source of current in the ignition systems of small aircraft engines, but larger engines use a storage battery system, similar to that of automobile engines. In both there are two



This double-row Wright Cyclone (above) develops 2,200 h.p. Inverted Ranger (below) has aluminum cooling fins.



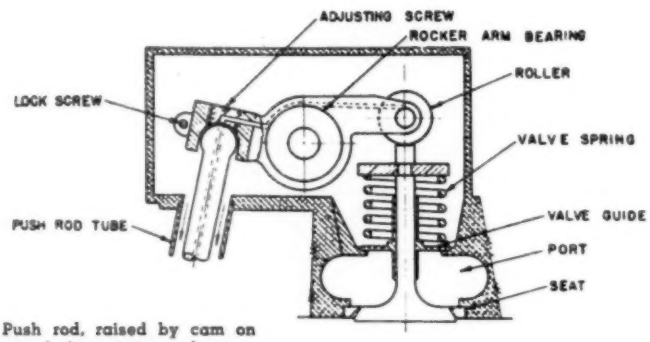


The 4 strokes of a 4-stroke-cycle engine are: intake, compression, power and exhaust. The spark occurs after compression, and ignites the mixture for the power stroke. Exhaust stroke clears the cylinders of burned gases.

electrical circuits, a *primary* and a *secondary*. In the primary or low-voltage circuit are included the current source (battery or magneto), a contact breaker, condenser and primary coil windings. In the secondary circuit are the secondary coil windings, the distributor and the spark plugs; it is the high-tension or high-voltage circuit. The magneto is turned by the crankshaft of the engine, and since there is no current until the engine is turning over, small power plants employing this system are started by "pulling through" the prop by hand. Battery systems usually have self-starters and a generator in the primary circuit to keep the storage battery charged. Timing of the engine is taken care of by the distributor turned by a timing shaft which is driven from the crankshaft or camshaft. There is a definite firing order for cylinders in the gas engine. In a 6-cylinder in-line engine, the order (numbering the cylinders from front to back) is 1-5-3-6-2-4; in a 7-cylinder radial with the top cylinder No. 1 it is 1-3-5-7-2-4-6.

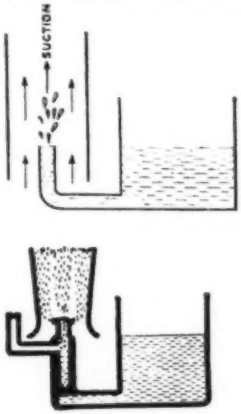
Almost all aircraft engines are equipped with dual-ignition. This is not only a safety precaution in case one system should fail, but the additional spark at the moment of ignition causes a more efficient combustion and increases the horsepower of the engine. Both sets should be checked carefully before take-off.

The lubrication systems of an aircraft engine are pressure systems. There are two types: the *wet sump* and *dry sump*. In the former the oil supply is kept in the crankcase of the engine and is [*Continued on page* 134]



Push rod, raised by cam on camshaft, operates rocker arm which pushes the valve open.

Carburetor is a device which meters gasoline to the intake air. Aircraft type has altitude adjustment.



LEAK-PROOF SKYLIGHT

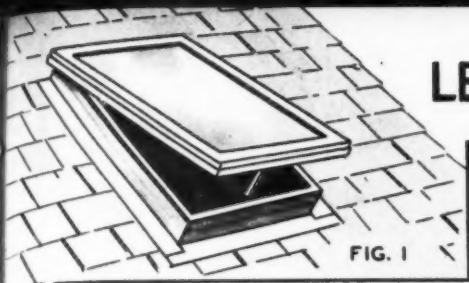


FIG. 1

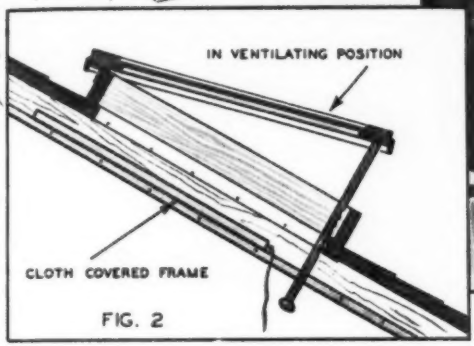


FIG. 2

FIG. 6
INSTALLED IN ATTIC

IF A room in your house is insufficiently lighted, you will be surprised how bright and cheery it can be made with a skylight. And ventilated, too. A storm-proof light can be made much cheaper than one would suppose, requiring only a standard window sash and a modest amount of material for the frame, flashings, etc.

In Fig. 1 is shown the completed skylight built over a small, dark kitchen. The sash is 24″x36″, and just the size to fit between two rafters. A lengthwise section is given in Fig. 2. A shade can be installed to slide along on rails secured to the rafters if desired.

A transverse section is given in Fig. 3, with a closeup of the frame installation. Make the frame exactly the width of the space between the rafters.

Partial assembly is illustrated in Fig. 4. Note that there is a molding or "skirt" all the way around on the sash, and at the lower end two notches to prevent water being trapped at that point. The putty side of the sash should be uppermost, but in cutting the notches, take care not to

[*Continued on page* 136]

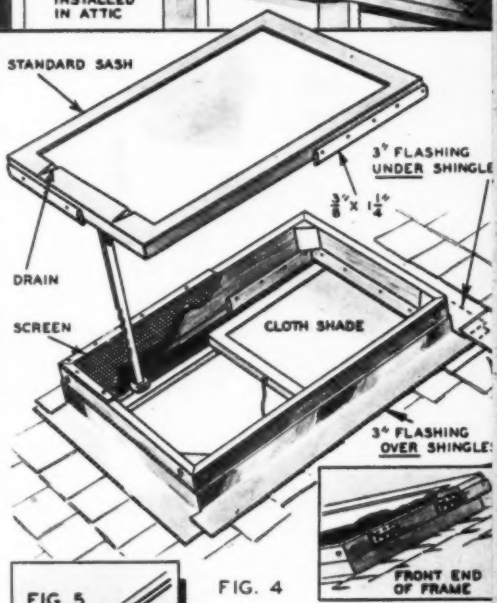


FIG. 4

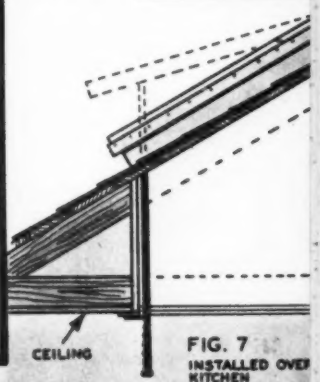


FIG. 7
INSTALLED OVER KITCHEN

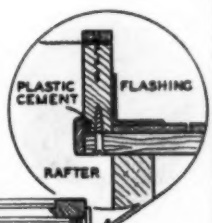
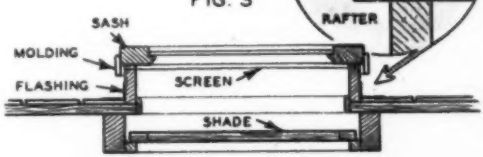


FIG. 3

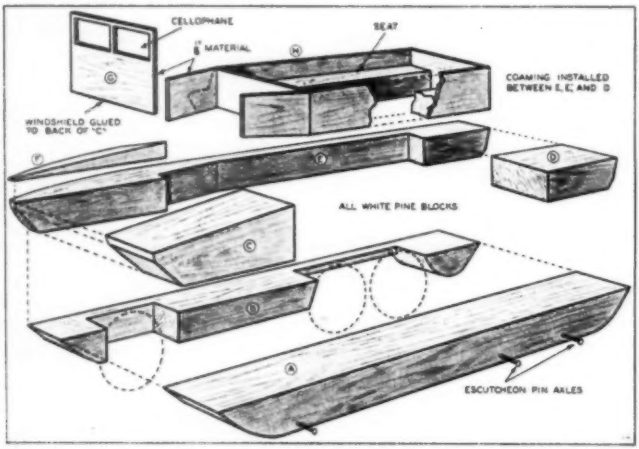


U.S. ARMY DUCK

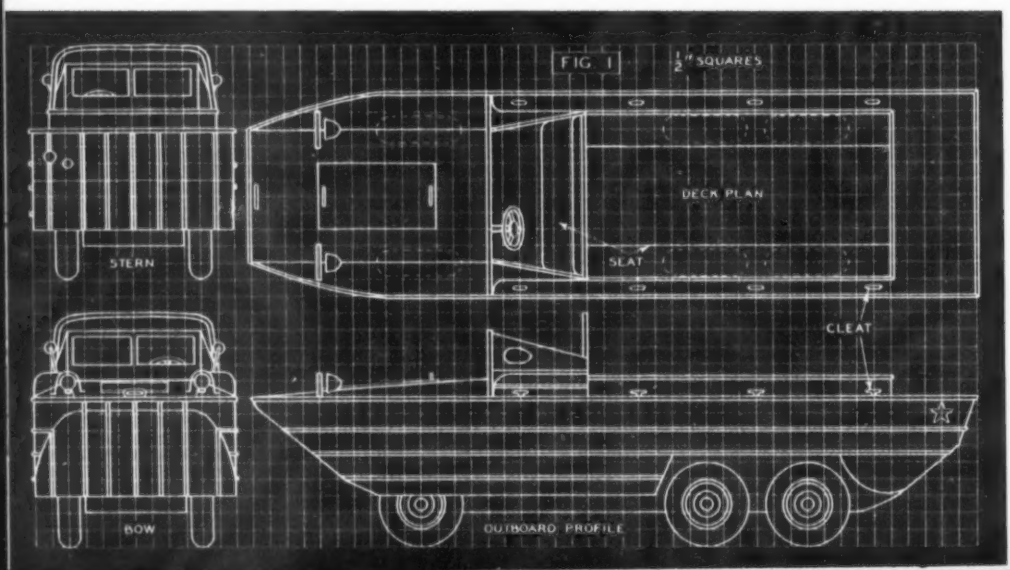
by Hi Sibley

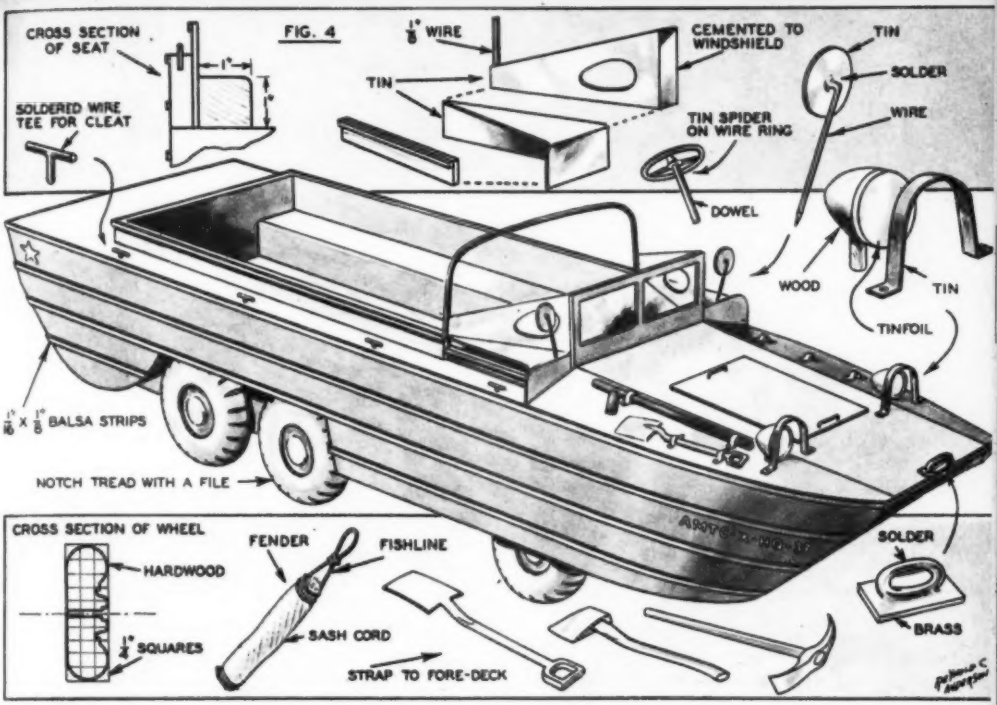
HERE is an all-wood model of our 2½-ton amphibious truck, a product of American ingenuity which has Adolf and Tojo plenty worried. It carries troops and supplies right from the ship to the scene of land action.

By building up the hull with a series of solid white pine blocks construction is easy for the novice. Study the four views in Fig. 1 before beginning the project. These give general appearance as well as over-all dimensions, and Fig. 2 shows sizes of the various blocks used in the hull, with their relative positions.



First make block A as shown in the drawing; this carries the escutcheon-pin axles for all six wheels. These should be installed before gluing on side members, B,B, right and left, which are cut away to accommodate the wheels. The hood C and afterdeck D are next installed on A, and





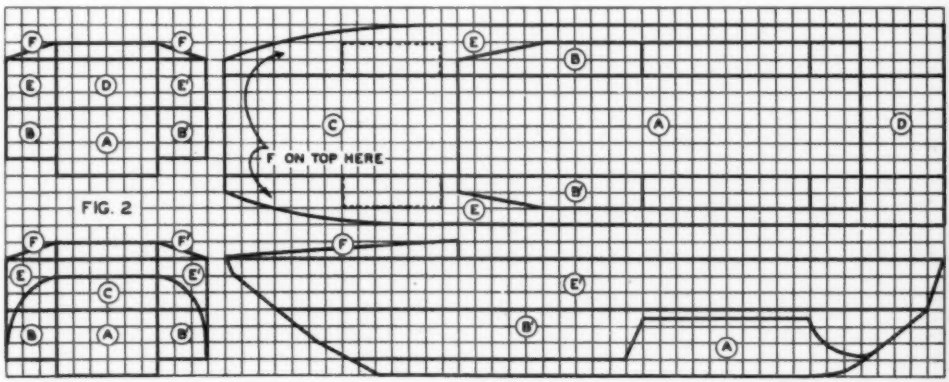
then the upper side members, E,E, right and left, are assembled. On each side of the hood C are sloping pieces F,F, right and left. When all the foregoing have been glued together, smooth up the hull with sandpaper so that the joints are not visible.

Now install the coaming around the cockpit, H, with the windshield unit G glued to the back of the hood C and cellophane cemented to the rear side of the windshield frame. All these pieces are ⅛-in. material.

Solid wood seats are installed along the sides of the cockpit.

Rear-view mirrors consist of bright tin disks soldered to music wire. Splash guards are of tin, as is the side member of the driver's compartment with oval window. A bow to support top or tarpaulin is bent from heavy wire and installed at the back of the driver's compartment. Steering wheel is made as in preceding models: a tin spider soldered to a wire ring 1-in. diameter, with dowel for steering post.

The wheels, first items to be assembled in building the hull, are lathe-turned from close-grained wood, [*Continued on page* 136]



SOLID MODEL OF ARMY'S AMPHIBIOUS TRUCK

IDEAS FOR SERVICE MEN

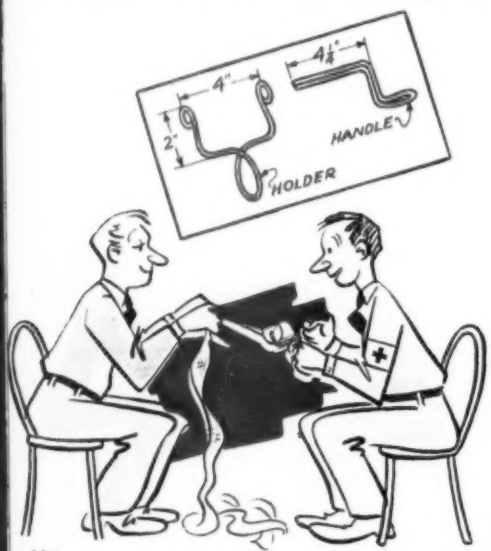
HEADQUARTERS, PANAMA CANAL ZONE DEP'T—Corporal Carl Cole, an ardent camera bug attached to the Panama Coast Artillery Command had a great deal of trouble capturing proper lighting effects in this photogenic territory. Not because there was anything wrong with the lighting, camera or Cole's technique, but simply because of an acute lens filter shortage.

Annoyed by the unsatisfactory results being obtained without filters, Cpl. Cole determined to amend the situation. He went to work and fashioned an excellent filter from parts of an old shaving stick case. His raw material was a white plastic holder cap with a threaded shoulder into which the shaving stick screws, held in a threaded collar.

Cpl. Cole drilled a hole in the holder cap to match his lens size. Into this receptacle he fitted an amber lens from a pair of good-quality sun glasses, grinding the glass down to correct size on an emery wheel. The glass was then held between the holder cap and threaded collar. Entire filter assembly slipped over camera lens mount and stayed put by friction. Photos of Cpl. Cole and his gadget are at bottom of opposite page.

PVT. PETER J. MAYER of Camp Gordon Johnston, Fla., has invented a neat gadget to speed up bandage rolling. Red Cross outfits, as well as Army medics might be interested in this idea. The holder itself is constructed from clothes hanger wire and is shaped something like a sling-shot frame, with loops in the wire at the business ends. Through the loops goes a straight wire handle, to which the loose

end of the bandage is attached for rolling. The rest is easy. One member of the rolling team holds the free bandage while the other cranks it up tightly on the handle shaft. Pvt. Mayer says the resulting rolls are neat and tight, and finished much faster than when rolled by the hand method.



THERE'S AT LEAST ONE MAN IN THE ARMY who isn't going to wait until peace comes to get a comfortable night's sleep, because he has a system by which an ordinary army cot makes like an innerspring mattress! Sgt. Wilford Vasher takes a cot frame and equips it with criss-crossed pieces of inner tube stretched across the frame and nailed around the edges. Bottle caps between nails and rubber hold the latter securely in place and prevent tearing.

"WHEN GETTING YOUR COTTON KHAKI TROUSERS TAILORED," says Raymond A. Hager, S/Sgt., Air Corps., "never have the extra material in the legs cut off." Reason is that the khakis have a discouraging way of shrinking after a few launderings, and the legs will have to be lengthened at least once a season. If there is no material to let out, the cost of having a facing put inside the cuffs is almost double that of the simpler operation.

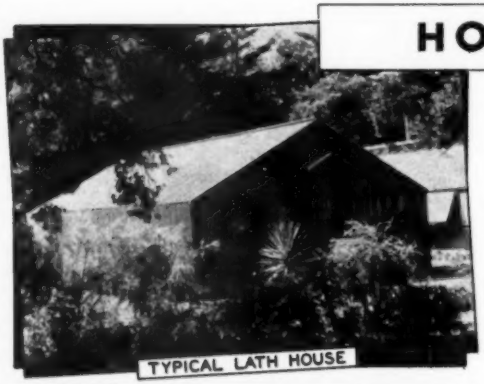
HERE'S ONE FROM PVT. JAMES W. HICKS, Amarillo Field, Texas: "I am an aviation mechanic, and have worked on a few cracked-up airplanes. A couple of them had to be rewired, and I was able to retrieve some of the heavy-duty electric cable. This cable is approximately ½" thick and contains more than 1,000 strands of wire. A three-inch piece of cable with the insulation cut away for about an inch, and the wire ends frayed, makes a dandy cleaner for the mess kit."

SERVICE MEN WHO HAVE TO WEAR G.I. GLASSES may find this tip from Pfc. Maylon Wilbur, Boswell, N. M., a useful one. Wilbur found that the bows of his glasses had a tendency to turn green, so he went to a radio shop and purchased a few inches of "spaghetti," flexible tubing used for insulation. This, slipped over the bows, kept the green color off his ears.

Cpl. Carl Cole, above, and his homemade filter holder, created from an old shaving stick case. Hole was bored through plastic top, filter inserted and held in place by means of threaded collar. Filter grips lens mount by friction.

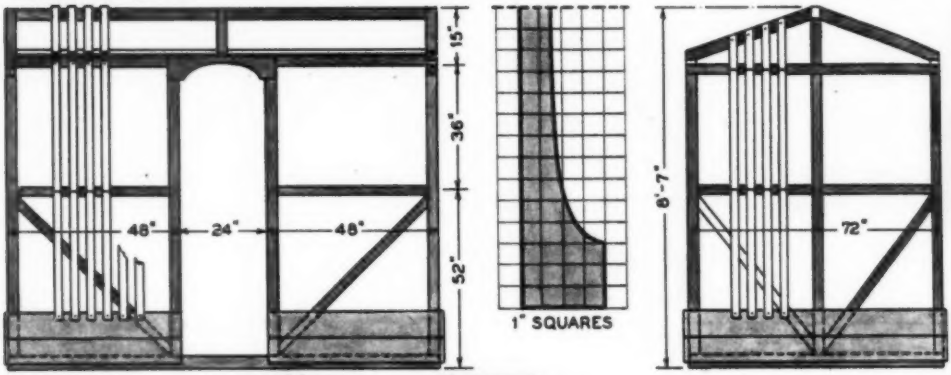
Coast Artillery Command Photos

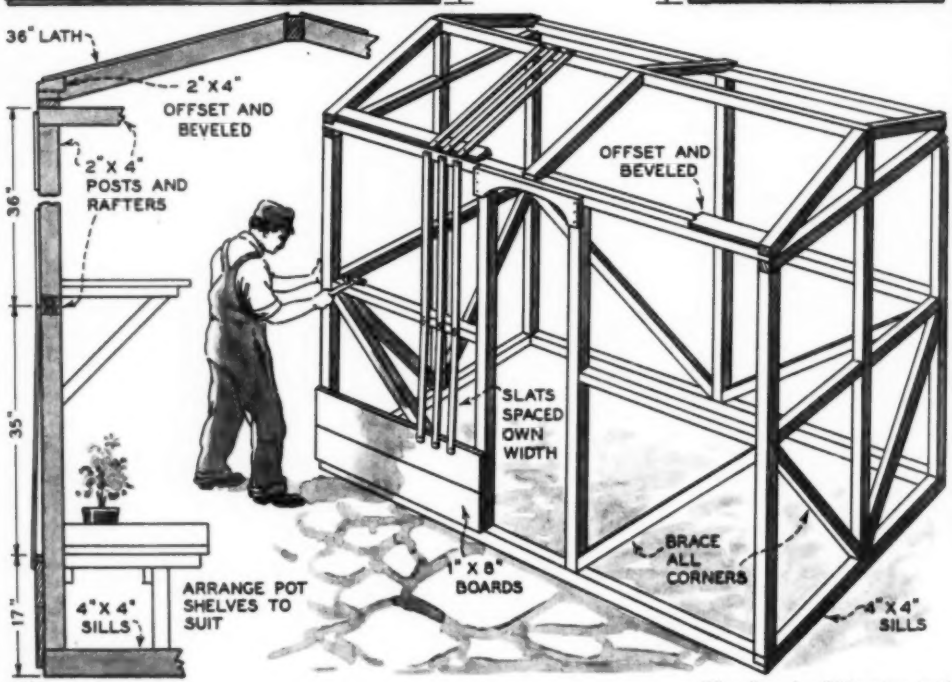
HOUSE OF LATH

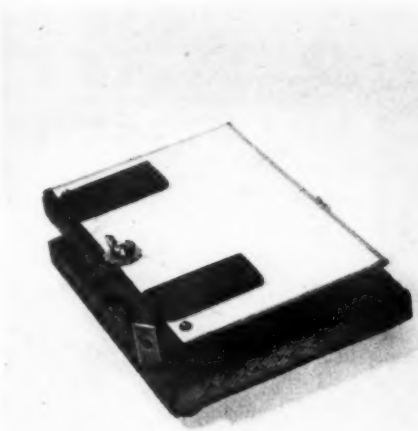


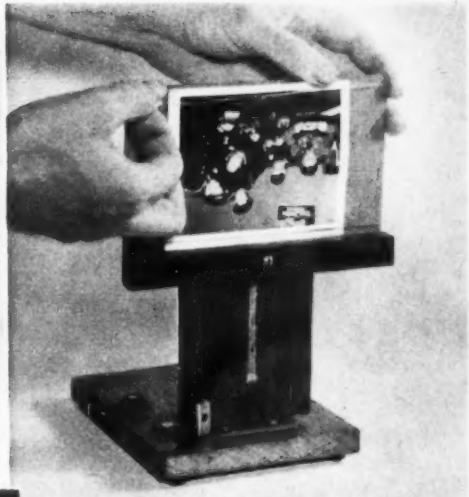
TYPICAL LATH HOUSE

A LATH house to protect seedlings and plants from sun glare is a simple project. Here are plans for a small house; they can be enlarged if desired. It has ample head room, requires only 36″ lath without waste, and the framing or siding along the bottom may be either used or rough lumber. The 4x4 sills should be tarred or creosoted to prevent decay. Locate east-and-west with doorway at north if possible.—*Hi Sibley.*









COPYING EASEL

This collapsible copying easel is easy to build and inexpensive. Alter size to suit your needs.

THIS easel will simplify your darkroom copying jobs. To make it you will need only a few pieces of scrap wood, a piece of cardboard, a hinge, two pieces of angle iron, a machine screw and wing nut and a few wood screws. The base is a piece 5½"x7" and the collapsible back is a piece 3½"x5". The copy holder is a piece of 5"x7" cardboard fastened to a wooden strip. A machine screw through this strip slides in a slot in the back, enabling the copy holder to be adjusted to a convenient height. A washer and wing nut hold the screw on the other side.

Angle iron braces, fastened as shown in the drawing, hold the back in an upright position. In order to hold the back steady when folded on the base, glue the sawed-off end of a wooden spool on the base in such a position that it will contact the strip holding the copy board. If desired, this wooden spool end may be located on the base directly under the hole in the wooden strip and a hole drilled in the base beneath it so that the machine screw and wing nut can be used to hold the copy board, back and base in folded position. Finally, to support the platform, fasten rubber-headed screws to the bottom corners.

Work to be copied can be held on the holder by means of rubber bands or thumb tacks. To copy larger work in this easel, mount the work on salon board and clamp the board in the copy holder.

In making minor adjustments for height, the copy holder and not the camera should be raised or lowered. This easel may be adapted to extremely close shots, also, by setting the copy holder on the reverse side of the back so the camera can be placed close to the work. Because it takes up so very little space, the easel will find plenty of room in your gadget case or darkroom accessory drawer.

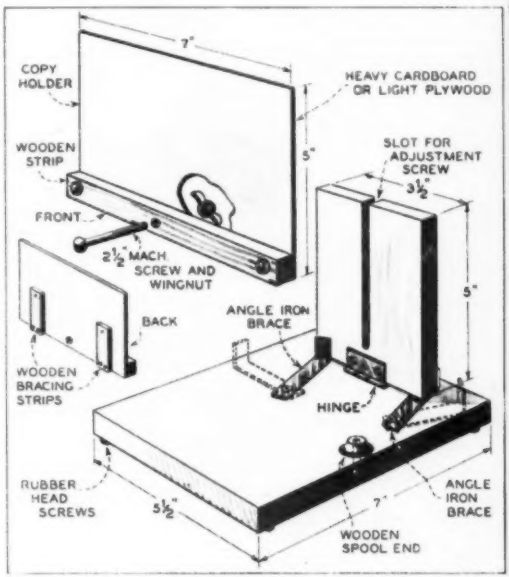


PHOTO CONTEST

FIRST PRIZE ($10.00): Student, by Eva Luoma of Hollidays Cove, W. Va.: taken with a Speed Graphic on Super XX film. SECOND PRIZE ($5.00): Go! by Bill Ficklin of Ithaca, N. Y. THIRD PRIZE ($4.00): A Couple For Tojo, by Pvt. H. Fialkoff of Camp Edwards, Mass. FOURTH PRIZE ($3.00): The Painter, by David Hussakof of Brooklyn, N. Y.

1st PRIZE

2nd PRIZE

3rd PRIZE

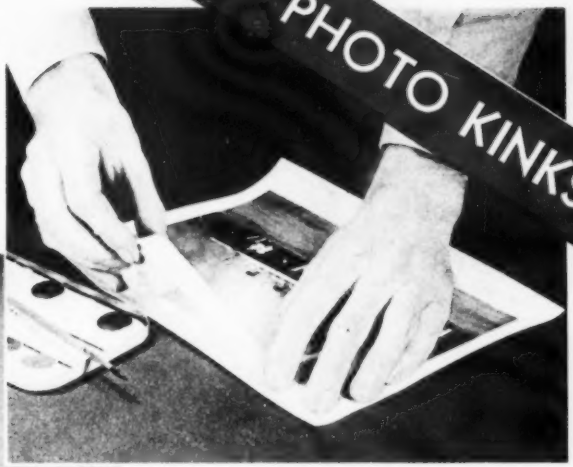
4th PRIZE

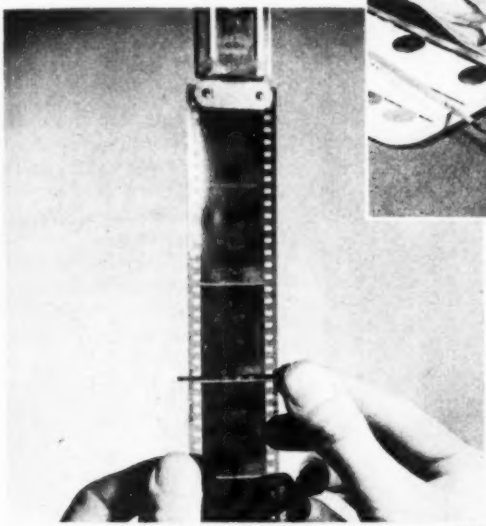
Submit contest prints unmounted—no larger than 8x10 inches. With each print list camera, film, lens opening and shutter speed, illumination and developer. Write your NAME and ADDRESS on the back of each print and wrap securely with cardboard or corrugated stiffeners. ENCLOSE POSTAGE for the return of unused prints. Published prints cannot be returned. Address: Photography Editor, MECHANIX ILLUSTRATED, 1501 Broadway, New York 18, New York.

PHOTO KINKS

by William Swallow

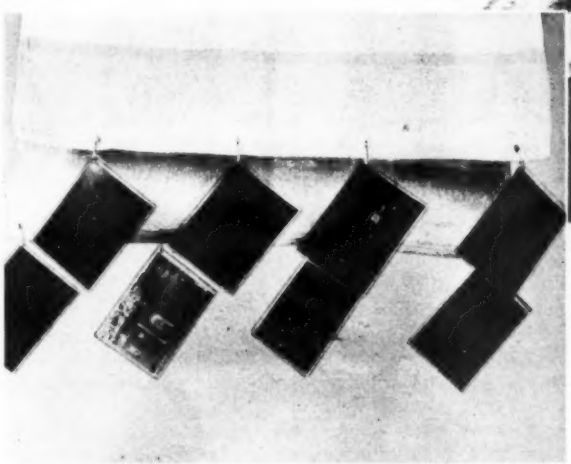
CLEAN BORDERS ON COLORED PRINTS: The next time you wish to color a print, cover the border with cellulose tape before you begin the coloring. The tape will prevent the border from getting smeared, and will assure even edges. Tape is removed easily.





DRY FILM FLAT: A 35-mm. film often takes on an objectionable curl from edge to edge when it dries and makes filing difficult. One way to overcome this trouble is to clip a bobby pin between two frames every five or six inches along film length.

SIMPLE DRYING RACK: An ordinary hand or bath towel makes a neat film-drying "rack" as below. Just hang the towel in its usual place or over the shower curtain rod, then attach the negatives to both borders of the towel by means of safety pins.



SIMPLE DYE FOR PRINTS: The dyes that are used for tinting dresses, shirts and other garments can be used effectively in tinting photographic prints as above. The dye is inexpensive and one package will serve for hundreds of prints. Fill a shallow dish or tray with water and dissolve in it a tiny bit of the dye. Soak the print for a few minutes, until the desired shade is obtained, then wash in fresh water. Many colors are available.

Exploring A PHOTO SUBJECT

Borda Cathedral makes a fitting backdrop for a typical Taxco street; life in the village revolves around it.

How careful planning and accurate shooting enabled the author to capture the spirit and quaintness of a little South Mexican village.

by Will Whitmore

THERE have been times when I have felt that my camera has let me down. I am sure the same feeling has come to every other person who has ever exposed a roll of film whether he be amateur or professional.

There was the time, for instance, that I visited Yellowstone National Park and spent a whole day photographing Old Faithful. The majestic, hurtling spout of water, the roar of steam and spray, the blue sky and white clouds, the dark rim of trees in the distance, the pools of clear water reflecting the glories of the surroundings so fascinated me and filled me with such a compelling desire to get it all on film, that I went dashing madly around burning up one roll of film after another. Surely, I thought, I have captured the thrilling beauty of the Park, but I was in for disillusion and disappointment.

I spent weeks in my darkroom working on those negatives, but the resulting prints were dismal failures. Solely from a technical standpoint many of the shots were good, but not one of them nor the sum total of all really expressed the beauty and thrilling grandeur of Old Faithful and its surroundings.

That experience taught me a lesson that every photographer must learn and heed. After the keenness of the disappointment had passed, I tried to analyze my failure. I saw that it had come as a result of my having no plan. I had thought simply, "Oh, boy, here's where I get some swell pictures," and then started to bang away. The pictures I had made neither adequately reported the entire scene nor interpreted it or any part of it. After showing them to a friend one night, it occurred to me that I had tried to make up for the inadequacy of the pictures by adding word descriptions. Thinking back, it came to me that I had really seen the place with my mind and heart as well as with my eyes. I had felt the mood of the Park, and my word descriptions had held my friend's attention and interest more than had my pictures. Did this mean, I wondered, if words were worth more than pictures in contradiction to the old Chinese cliche "one picture is worth a thousand words"?

Of course, no photographer, not even a struggling amateur like myself, would admit

to such blasphemy, but it set me thinking. There must be a similarity in the creative approach between the writer who describes with words and the photographer who describes with a camera, I thought. The writer may attempt to describe a scene or the action which takes place in a certain scene. He, of course, is the reporter, and he simply attempts to portray in words what he saw. His job is not to interpret but simply to describe. Or the writer may both describe the scene and try to interpret its significance. When he begins to interpret he is no longer satisfied with a description of the mere physical aspects of the scene or action; he attempts to recreate the mood of the scene as well.

The photographer, of course, does have the same aim as the writer. He attempts to describe or to interpret a scene. If he does the former he is reporting with a camera and we may call him a photo-journalist, or a photo-documentarian, and we may call his picture a news-photo or a documentary picture, or just a plain "record shot," if you please.

If he attempts to describe and interpret a scene, then we are apt to call him a pictorialist, and his work may be classed as a salon print.

The author's survey had to include a beggar such as this one if his series was going to depict Taxco life.

Here the photographer singled out one of the carved figures on the Cathedral facade. The eroded surfaces of the columns are a clue to the age of the edifice.

This analogy between the writer and the photographer helped me to see what I was striving for in photography and to understand better the reason for my failure. How does a writer approach the job of describing or interpreting a scene? Does he jump all over the setting and describe something near at hand in one paragraph and then jump to the far horizon in the next as I had done in trying to "describe" Old Faithful? Well, hardly.

If the writer is to describe a house sitting in a spacious grounds, he begins by telling what his eyes are actually able to see from his distant point of view. As he approaches the house, he continues to describe those things which his eyes take in. The more nearly he makes the reader feel that he is actually present with the writer as he approaches the house, the more graphic his description becomes to the reader. The writer does not describe the interior of the house until he has made you see the exterior and has taken you through the front door of the dwelling. In other words, he establishes a point of view and he describes at any one time only those things which are actually physically in the scope of that particular point of view. The reporter, if he is successful, describes the entire scene. The interpretive writer, how-

shadows, the strangeness of the people, their customs, their homes and everything that went to make Mexico thrilled me so much, I wanted to grab my camera and run through the streets aiming it at everything I saw. As a matter of fact I did just that for the first few days I was there.

But finally on the eve of my going to the little village of Taxco my "better judgment" began to curb my enthusiasm. Taxco, is supposed to be one of the quaintest towns in the country, I told myself. Here is a challenge for you. Can you describe the village, its age, its people, its customs? Can you interpret all this as well as describe it? What's more, can you do it all in about four hours' time? Our

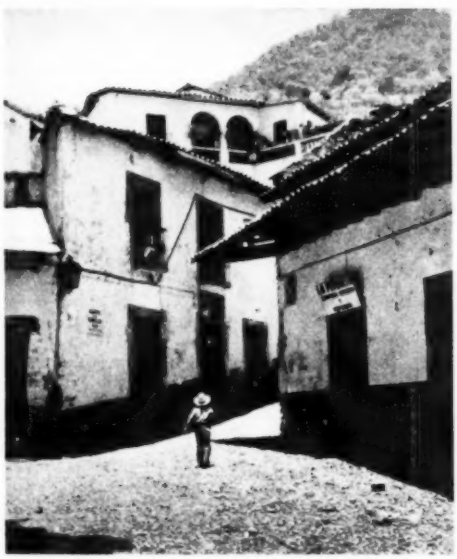
A close-up of the Cathedral towers reveals their interesting outline and carved statuary.

ever, is interested in the mood of the scene, and he describes only those things which add to the mood he is attempting to portray.

Either writer has a purpose and a plan. The reporter attempts to show the reader everything which will help him to visualize the scene. The interpretive writer shows him enough to make him feel the mood of the scene. The writer, if he is successful, never confuses his job. He knows what he wants to do and he does it.

I now fully understood my failure in attempting to photograph Old Faithful. I had had no real purpose or plan. I had neither described nor interpreted the scene. I simply shot up a lot of film.

All of the above has been long and perhaps dull, but the thinking-through process really did help me in my approach to photography. Let me now be practical and show you how I applied my thinking. Last summer I made a trip to Mexico and the variety of life and scenes almost undid me. I found myself feeling as I had felt at Yellowstone. The beauty, the variety, the brilliant sun, the dark

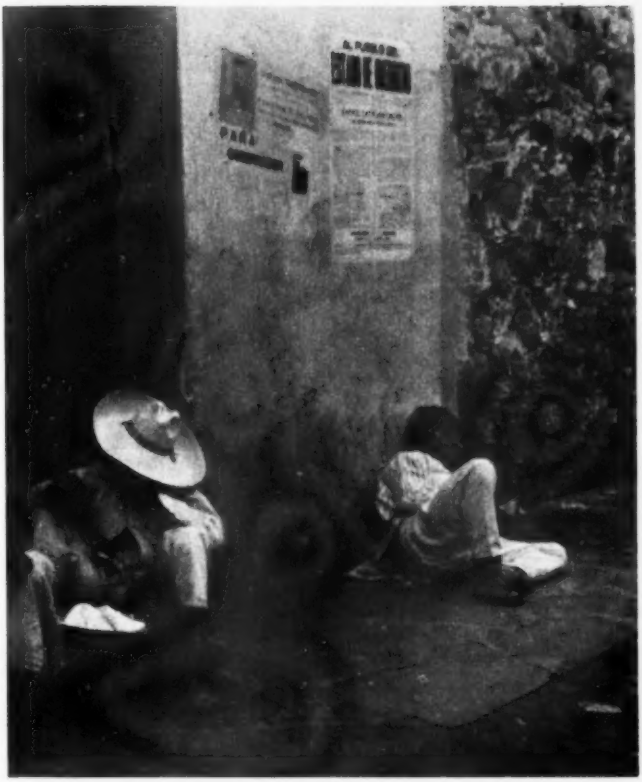


An accurate representation of Mexican siesta time when the hot sun beats down on the pavement.

itinerary would permit no more.

Taxco is some one hundred miles southwest of Mexico City. The road climbs steeply in a serpentine fashion over a high mountain range and as the crest is reached, suddenly there comes into view far down the side of the mountain the little 17th century village. The town spreads out before you and even at this distance one can see the famous twin towers of Borda Cathedral in the center of the town, dominating the entire scene.

Every place I looked as the car descended to the village seemed like a beautiful picture. My hands itched for the camera as they never had before, but I kept it in its case and contented myself with looking and really seeing. When we arrived in the central plaza with the Cathedral occupying most of one side, I left the car and spent the next hour of my precious four exploring.



Taxco siesta time. The natives require nothing more than a shady spot and a wall to lean on. These apparently lazy men really are hard workers.

At the end of the hour, I knew pretty well what I wanted to do. I had soon realized that the famous old Church was the focal point of the life of the entire town. The narrow, winding, steeply pitched streets all seemed to lead up to the very front door of the Church. Its towers always seemed to be looking down on you no matter where you went. I decided that I must interpret the town through the dominating influence of the Church.

The town enjoys a fine tourist trade, and it has a thriving silversmith industry, yet, I felt the same "manana" spirit of ease, laziness and indolence which is at least a surface characteristic of much of Mexico. I saw the poverty, too, of many of its citizens. The town, too, was full of tourists. All these things, I felt, I had to describe and interpret if I were successfully to photograph the town.

In that short hour's survey, I had found scenes and places which would describe everything I saw and felt about it. At the end of the hour, I knew what I wanted to do and I set out slowly and carefully to do it. One shot of a blind beggar sitting in the shade was enough to tell something of the poverty. I expressed the dominance of the Church over its surroundings by having a portion of it show in almost every picture. This, with a little planning, was easier than it would seem, so prominent is the Church structure. The age of the village also was told with pictures of the Cathedral, which happens to be one of the town's earliest edifices.

I wanted to describe the Church fully. I began shooting it from a distance of several blocks. I took long shots of the towers, and just as the writer would describe it, I took succeeding shots, each time approaching nearer to the front of the building. It has exquisitely carved stone figures on the towers and on its face. The sun shining on a carved figure of a saint made wonderful shadows and highlights. It also [*Continued on page* 132]

KEEP IT ROLLING!

Hints For Your Wartime Car

FOR SAFETY'S SAKE be extremely careful how you use a bumper type of jack. With many of the older cars a better hold can be had by placing the jack under one of the bumper arms rather than under the bumper bar itself. Smart motorists start the lifting job with a bumper jack and complete it with a jack that can be put under the axle. (Photo 1)

CLEANING THAT CONVERTIBLE TOP is a matter of rubbing with a piece of rough cloth, or toweling, saturated with carbon tetrachloride or other good cleanser. Carbon tetrachloride can be purchased at drug stores. It will do a better job than washing with soap and water and with none of the usual mess. (Photo 2)

TOO MANY ENGINES are set for incorrect idling due to the fact that owners fail to consider the effect of temperature changes. A setting made for a warm engine may not be fast enough for the engine when cold, or the adjustment may seem to be right for both temperature extremes yet the engine may stall every time the car is stopped abruptly. Experience calls for an idling speed a bit on the fast side.

NOISES ARE EXPENSIVE when, like H. M., you spend $14 to have the chassis tightened and a shock absorber replaced only to discover that the noise still is on deck. He should have given more thought to the spare tire which was loose in its holder. He discovered the fact when a newcomer at the neighborhood filling station overinflated the spare, just enough to take up the slack. (Photo 3)

HIGH OIL CONSUMPTION may be due to a punctured diaphragm in the vacuum pump part of the fuel pump, if your car carries this feature. You can make sure about it by disconnecting the booster line from the pump to the intake manifold and then holding a piece of paper in front of the pump

by Frederick C. Russell

opening while the engine runs. If no oil sprays out, the diaphragm is intact.

LIKE THE HUMAN CHASSIS your car's various "organs" have curious effects on each other. Too much back pressure in the exhaust from a pinched tail pipe or the wrong kind of muffler burns valves. (Photo 4) A grabbing clutch will raise havoc with the rear end. Sag at the rear of the car will increase front-end caster and give you shimmy. All of which gets around to answering a reader who wanted to know how worn universal joints could cause front-wheel shimmy. Simple enough. Being loose the worn joints allow the propeller shaft to whip. This sets up sufficient vibration to upset the front end.

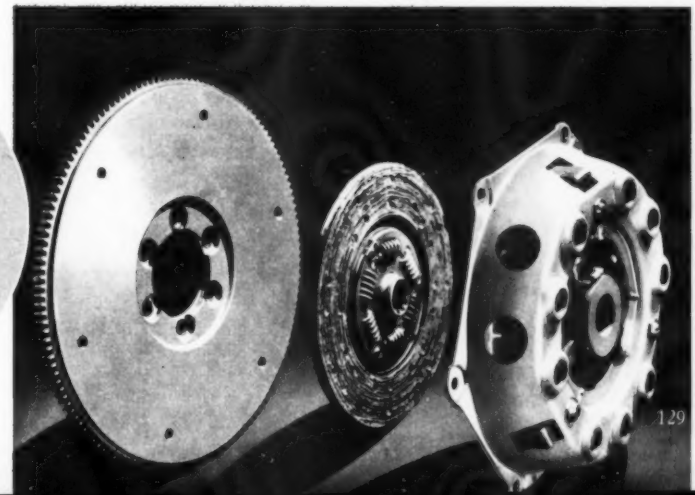
DON'T WORRY ABOUT oiling the arms of your luggage compartment lid. Even if you don't lubricate the moving parts regularly, they will hold as well; this is one case where wear won't do too much harm. A bit of grease never hurts, however. (Photo 5)

HINT OF THE MONTH

Testing the acceleration pump's efficiency may sound like a difficult job but actually it's quite simple. You first remove the air filter and set the choke valve in the open position. Then you look into the carburetor throat with a flashlight while an assistant presses down rapidly on the accelerator. At this point you should clearly see a steady spray of gasoline into the carburetor throat. This—if the acceleration pump is in good condition—should continue for a few seconds after the throttle has been opened.

Your car needs careful attention, particularly during wartime. If you have a problem with your car, ask Mr. Russell. Just send stamped, self-addressed envelope to him at Mechanix Illustrated, 1501 Broadway, New York 18, N. Y.

If your car starts smoothly for awhile after you have had the clutch plate relined but soon starts chattering again, it means the plate is warped. Take apart and straighten.



CHIPPENDALE FRETS

THOMAS CHIPPENDALE designed many beautiful and delicate frets which can be used in a variety of ways by the craftsman in ornamenting furniture and other objects. They are appropriate as grills, panels, borders and edgings. They may be jigsawed, routed or carved, and may be applied as inlays, overlays, carvings or painted decorations. A few suggested uses are as grills for glass doors such as cabinet or bookcase doors, radio speakers, bookcase ends, and the panels and borders of cabinets.

The designs may be repeated or a suitable portion of a design may be used, or their proportions may be altered to fit within a desired space.

To finish mahogany, apply stain or leave natural color and then apply a filler. Sandpaper, spray with clear lacquer and finally wax. For an antique finish on maple, stain, sandpaper the highlights, lacquer and then wax.

More power to all the G. I. Joes who brag about the wallopers they caught . . . and the still bigger ones they'll catch in happy days to come. The boys talk a heap of fishing, we're told. Maybe those big Evinrudes that serve with them help sharpen old fishing memories — and appetites!

One of those great Storm Boat Evinrudes would make at least a dozen fast, smooth, rugged fishing motors . . . the kind they'll want when they get back. And we'll do our darndest to please them!

FREE! Send for this special issue of the "Evinrude News". A pictorial magazine that covers outboards in war and peace — profusely illustrated with photos showing Evinrudes serving the Army and Navy, and pictures of happy peacetime uses to follow! Write today for your copy! EVINRUDE MOTORS, 5072 North 27th Street, Milwaukee 9, Wisconsin.

EVINRUDE
OUTBOARD MOTORS

★ EVERY DOLLAR YOU INVEST HELPS SPEED VICTORY . . . BUY MORE WAR BONDS

Microscope With Attachment

[*Continued from page* 87]

or very close to them. Get the exact specifications from the dealer. Be certain that the lens units are perfectly centered in the mounting bushings cast in the tubes, and that the tubes are perfectly concentric. If your lathe technique is correct, this should all be a matter of course. If your lathe is a thread-cutting one, by all means thread the tube bushings to take the lens mountings.

The projector camera unit is made almost entirely of heavy drawing paper. A paper tube about 1½" long is rolled and cemented along its seam, the diameter being such as to make a snug slip-on fit on the upper end of the microscope draw tube. A paper cone is formed next. The small end of the cone is trimmed to fit snugly over the paper tube, while the large end is made of the proper size to take the particular size ground glass used. (A good size is 3¼"x4¼".)

Next cement the small end of the cone to the tube, lining them up carefully. The large end of the cone is shaped into a rectangle slightly larger than the ground glass by means of a cardboard frame which is pressed down from the top of the cone to a point where the sides of the cone are drawn tightly to the edges of the frame. Then it is cemented in place. Cone should be proportioned so that the distance from the top lens of the microscope to the ground glass is approximately 10". At this distance images will appear the same size as when viewed through the lens directly, and a 150-watt bulb with a condenser will provide ample light.

A light shield to keep outside light from the ground glass is made in the form of an open-ended rectangular paper tube. Short, pointed tabs are bent inward at the bottom end to rest on the ground glass, and alternate tabs are bent out slightly, holding the shield centered.

The entire unit is painted black inside and out with quick-drying paint or lacquer.

The ground glass simply rests in place on top of the cardboard frame, and may be replaced with a film holder or film pack for microphotography. This should be done in a darkroom, and a heavy dark cloth bag should be slipped over the cone top to keep out outside light. Exposures are made by switching on and off the regular microscope light source used, focusing first with the ground glass.

The 150-watt bulb can be used without a cooling cell in this setup even when watching live protozoa. It will be necessary to adjust the light source, condenser, and microscope mirror carefully so that light is concentrated as nearly as possible to a point on the specimen on the slide. Specifications are for moderate powers; higher powers will require more illumination.

From experiments with lizards, a scientist infers that reptiles require hotter weather to bring them out of hibernation than the temperature that drives them into burrows in autumn.

Exploring A Photo Subject

[*Continued from page* 127]

revealed the erosion of time and weather, the chipped and scaled surface that only centuries could have created. A close-up shot of the stone saint told more eloquently than would have the town records, of the age of the Church and village.

As the siesta time approached, the little side streets became almost deserted except for the men, women, and children sleeping in the shade in the classic Mexican posture. A picture or two of these empty streets with its sleeping sitters was enough to register that quality of indolence. It was my wife who saw a small boy walking down a completely deserted street with a man sleeping in the balcony of a house in the background. Her picture of that scene truly describes and interprets the siesta custom and the easy-living of the natives. The little boy emphasized the emptiness of the streets.

I took more than forty pictures in the space of three hours. The great majority of them were good; every one of them added to the story which I wanted to tell about Taxco. Not one of them was superfluous. I perhaps could have made more pictures without a plan, but they would have been just pictures.

I am not fool enough to think that three hours of picture-making is enough time to do justice to Taxco. My ambition is to spend a month or more there some time. However, I do feel proud of the pictures I made. They were completely satisfying to me, and I believe that they do in good measure serve to describe and interpret the little town. I know that I would have failed completely had I simply banged away as I had done the year before at Yellowstone. My thinking-through of what I, as a photographer, wanted to do and how I could go about doing it were well worth the time and mental effort.

Layout For Machining

[*Continued from page* 102]

Divider: Shaped like a pair of calipers with an adjusting screw in the middle.

Punches: To punch marks for holes; should be hardened.

Ball peen or *jeweler's hammer*: Small; for punching hole marks.

Vise: A bench vise is adequate for most work; a drill vise is needed for round work and specials.

Protractor: Preferably one of those combination jobs with a 12" scale, center head and protractor head.

Depth gauge: Handy for measuring inside.

Also a *surface gauge*, small *anvil* and ground and identical *V-blocks*.

To reduce night traffic accidents in Navajo Indian country, efforts are being made to have Navajo wagons equipped with red reflectors visible 300 yards.

A Camera Fan is MADE...not born!

Johnny got his start at age 13, with a *Universal*. For even then Universal was ahead of the field, by providing a candid camera at a price so low that millions of little Johnnies could afford to buy it.

Among Johnny's first pictures are this and the one at left, of the kids next door. They're certainly no prize winners . . . but Johnny, like most beginners, didn't know so much about composition in those days.

When Johnny entered high school, Dad gave him a better *Universal*. He joined the school camera club and started reading hobby magazines like this one. Some of his photos even made the school year book.

College meant new camera thrills to John, with his *Universal Mercury*. Universal was again ahead of the field with a camera that could stop action faster than any other candid camera available before the war.

John's not taking many pictures now. But you should have seen his eyes light up when he spotted Universal's name on his Navy *Binoculars!* Universal's at war, too, making fine military optical instruments!

The war will end...

And thousands of Johnnies will come home. Then, fans like John, and others who aren't fans yet, can look forward to a whole new series of great Universal cameras and photographic equipment. For Universal is still pioneering . . . this time in methods of large-scale precision production of military optical instruments. Count on Universal to utilize these achievements in its postwar camera program. *Expect your next camera to be a Universal.*

Remember: One picture from home is worth a thousand words to a Serviceman

UNIVERSAL CAMERA CORP.

NEW YORK • CHICAGO • HOLLYWOOD

Peacetime Manufacturers of Mercury, Cinémaster, Corsair Cameras and Photographic Equipment

[*Continued from page* 114]

drawn off by a pump and forced under pressure to the crankshaft; from this it sprays on the cylinder and piston assemblies. This is called *splash* lubrication. In the dry sump system, the oil is kept in a tank outside the engine and is forced by a pressure pump to the engine parts. Then it drops to the bottom of the engine where it is drawn off by a scavenger pump and returned to the tank. The wet sump is not as desirable as the dry sump system because of the limitation of oil capacity, cooling difficulties and the fact that a motor so equipped will flood with oil in inverted flight.

Aircraft engines may be air-cooled or liquid-cooled. Air-cooled engines are usually of the radial type, although the air-cooled Ranger engine is a V-type. Cooling is accomplished by allowing the air stream to pass through fins projecting from the cylinders and heads. In air-cooled engines other than radial, a series of baffles is used to direct the air past the cylinders. In liquid-cooling systems, a jacket surrounds each cylinder, and through it is pumped a coolant such as water or Prestone. This coolant passes to a radiator which is exposed to the air stream, and then returns to the cylinders.

Much has been said about the relative merits of these two systems. The air-cooled engine offers greater resistance to air flow and so increases parasite drag, even when equipped with an engine ring cowl for streamlining, but on the other hand, it does not have the extra weight of coolant to carry.

The important instruments for the light-plane engine are the *tachometer, oil pressure gauge* and *oil temperature gauge.* The tachometer measures the r.p.m. of the engine. It consists of a flexible cable, one end of which is attached to the engine crankshaft and the other end to a centrifugal governor in an instrument case on the panel. As the engine turns, it turns this cable at the same speed and causes the governor weights to fly out, moving a pointer across a calibrated scale. The faster the engine runs, the faster the cable turns, the greater the effect on the weights and the higher the reading on the dial. Some tachometers are electrical; they are used in planes where the engines are quite a distance from the pilot's position.

The oil pressure gauge makes uses of a Bourdon tube in its construction. This is a curved, flat tube sealed at one end and with the other end connected directly to the oil system. No air can be present within the tube. To its sealed end is connected a pointer by a gear and lever. Just as water pressure will cause a coiled water hose to whip around and try to straighten out, the oil pressure tends to straighten out the Bourdon tube. The greater the pressure, the straighter the tube and higher the pressure indicated.

Oil temperature gauges can operate with a Bourdon tube. In this case an airtight tubing system, containing a quantity of liquid, has one end inserted in the oil. The heat of the oil causes a change in vapor pressure in the system which affects a Bourdon tube at the instrument end. Electrical thermocouples are used for measuring cylinder head temperatures.

In this chapter we have covered briefly the principles of the aircraft engine. Of course it is not possible to discuss the subject more thoroughly in such a short space, but the facts we have covered are ones which will enable you to appreciate your plane engine and to treat it intelligently so it will reward you with faithful service.

The following are inspections you should make on your engine each day before flight:

1. Check the magneto ground wire to see if it is tight. (The magneto is shut off by grounding it. If the wire is loose, the magneto will be turned on even though the switch says "off," and the person who spins the prop will be in great danger.)

2. Examine the engine cowling to see that there are no cracks present and that the cowl is fastened securely.

3. Check the exhaust stacks and the cabin heater so cracks will not permit exhaust gas to escape into the cabin.

4. Check the ignition wires to see that they are fastened to the spark plugs securely. Make sure that the connections are free from grease and dirt.

5. Drain the sediment and water from the strainer bowl on the gas line to the carburetor; this might prevent a forced landing.

6. Check the oil and fuel supply with a clean stick; don't trust the gas gauge. Make sure the gas cap is on tightly and that its vent is open.

(The School Shop aviation lessons are being published in book form titled HERE'S HOW TO FLY. The publisher is Duell, Sloan and Pearce of New York City.

There are 21 chapters and over 200 illustrations covering history, aerodynamics, navigation, meteorology, engines, load factors and parachutes, and a special chapter of 200 multiple-choice questions and answers like those used on C.A.A. Private Pilot Examinations. The price is $2.50. Copies may be obtained by writing to the Aviation Editor of MECHANIX ILLUSTRATED. Make check or money order payable to Duell, Sloan and Pearce.

Finding an ailanthus or tree-of-heaven in California almost always means the site of an early settlement, says an agriculturist, who explains that Chinese miners and early American settlers introduced this tree.

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Multi-Voltage Transformer

[*Continued from page* 93]

¼", and those in the other piece $\frac{3}{16}$". Cut a shoulder on the two pieces of ¼" round steel and thread the opposite end as shown at figure 11. Rivet the ends of the threaded rods in the $\frac{3}{16}$" holes in the piece of band steel. Place the two pieces over the upper section of the core and clamp in place with two wing nuts. To change secondary coils it will be necessary only to loosen the clamp and remove the upper section of the core.

The sockets for the coil-connecting leads are made for pieces of ¼" round brass rod, as shown at figure 14. A ⅛" hole is drilled in one end of the brass piece, after which it is slotted to make a tight fit on the end of the terminal screw, figure 13. A 3/32" hole is drilled in the opposite end, in which the connecting wire is soldered. Four connecting leads will be required; two short leads to connect between adjacent terminal screws and two long leads to connect between terminals on opposite sides of the terminal strips. The connecting leads should be of flexible wire as large as the largest size used in the secondary coils.

LIST OF MATERIALS

9 lbs. transformer steel
1¼ lbs. magnet wire, No. 20, D. C. C.
Wire for secondary coils (see text)
6-ft. lamp cord, No. 18, rubber covered
1 attachment plug cap
2 pieces angle iron, 1½" x 1½" x 8"
2 pieces band iron, ¼" x 1½" x 6"
4 pieces round steel rod, ¼" diameter, 2½" long
4 steel nuts, hexagon, ¼"
2 steel nuts, wing, ¼"
8 machine screws, F. H. brass, 8-32, 1½" long
8 M. S. nuts, hexagon, brass 8-32
8 knurled nuts, brass, 8-32
2 pieces wood, ½" x ½" x 4½"
1 piece wood, ⅝" x 1½" x 1½"
4 wood screws, F. H. bright, ½", No. 6
5 wood screws, F. H. bright, ¾", No. 6
8 pieces round brass rod, ¼" wide, 1⅛" long
Winding jig (see text)
2 ft. Stranded wire, rubber covered, for terminal connections (see text)

U. S. Army Duck

[*Continued from page* 117]

such as maple. Fenders to protect sides and bow are made of short lengths of sash-cord with ends bound with fishline. These are hung from the cleats before landing at a dock. Tin foil is cemented to the headlights for lenses and with the exception of these and faces of look-back mirrors, the entire job should be painted olive drab with a white star near the stern on each side.

To keep this in proportion with earlier models in this series, the squares in Fig. 1 are ½ in. If you prefer, you can make it one-half size by using ¼" squares.

An 800,000-word handbook of Federal Indian Law has been prepared by the Government.

Leak-Proof Skylight

[*Continued from page* 115]

crack the putty. The skylight frame is mitered at the corners and reinforced with three-cornered cleats. Screws are used instead of nails. Galvanized fly screen is tacked on top of the frame with a wood strip covering the edges.

The sash is hinged at the upper end and the ratchet-bar installed on the other with a recessed bracket (Fig. 5). The ratchet engages with a small plate at the bottom of the frame. Make a light frame for the shade cloth and use a material that can be renewed at intervals.

Appearance of the skylight in an attic is illustrated in Fig. 6, and a sectional view of one built over a first-floor room given in Fig. 7. To render the skylight inconspicuous from outside, paint or stain the wood as nearly like that of the shingles or roofing as possible.—*Hi Sibley.*

Dress Up Your Windows

[*Continued from page* 105]

nailed together at the top and bottom with a cross piece.

Especially attractive for a small window is a lattice and shelf surrounding it. A shelf on which flowerpots may be placed is set several inches below the window. The shelf is supported by a cleat nailed to the wall and two brackets which are notched to fit over the cleat.

The appearance of a full-length window or door is furnished to some extent by two lattice wings on either side of a casement window. These should be about half the size of the full window. The wings are made of 1"x2" stock in a frame style with diagonal slats nailed to it.

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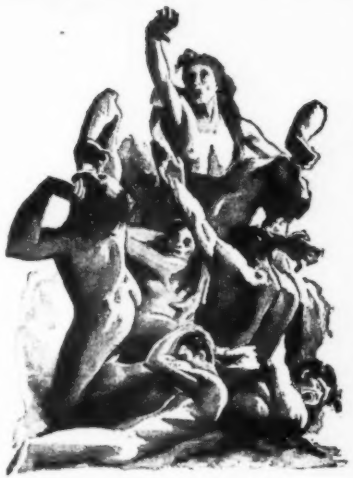

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The Potter's Art

[*Continued from page* 101]

press from the outside with the left hand so as to draw the top in. Let the right hand drop lightly below the left on the outside. This is a hard process to describe, but the hands should just follow the shape of the bowl that the worker has in mind. Only practice will gain the skill desired.

The throwing is now over. Run a fine wire under the piece and remove from the wheel, leaving the pottery on the board. It will now stiffen and shrink and the cutting loose with the wire is to keep the bottom from cracking.

Turning: If the throwing has been well done, all that will be needed in the line of turning is the bottom of the piece. When the thrown shape is leather hard, place it upside down upon the potter's wheel. Holding gently with both hands, slowly revolve the wheel. Let the piece turn and gradually work it into the center of the wheel. When it feels to be perfectly centered test with a pencil by holding the pencil on a turning stick and marking with a line the amount the pottery may be off. Draw to the center, test again, and when in perfect position fasten in place with pinches of clay. A set of turning tools must be made, similar to those in the illustration, unless you have already purchased some. Holding the stick with the left hand and the tool with the right turn the bottom into a perfect shape. The stick is about the length of a broom handle and has a point in one end to stick into the upright board, while the other end is held under the left arm. The tool is held firmly against the stick by the right hand and the movement is made by moving the stick rather than by moving the hand.

Sponge the piece now perfectly smooth and set away to dry. When dry it is touched up with sandpaper and is then ready for firing.

Next month's installment will cover the firing of the clay and the making of cast pieces.

California agricultural and forestry officials are to distribute 10,000 cork oak seedlings to landowners, to establish a cork industry in the state.

As far back as 1857, a railroad tried car-cooling for perishables by insulating some box cars and placing ice in doorways after cars were loaded.

About 600 boats are now fishing in California waters for soupfin sharks that yield a liver oil richer in vitamin A than codliver oil.

About 10,000 Army Air Corps officers are to be taught Spanish, the vocabulary being adapted to air corps needs.

"It'll do everything but lay an—Oh! Oh!"

Cycles Predict The Future

[*Continued from page* 49]

clearly marked by cycles. Christianity, the most democratic religion the world has ever known, is a typical cold culture phenomenon. At the time of Christ, world climate was turning colder, much as it is now. A revival in religious interest is due, and indeed has already begun. Some of this revival may be attributed to the war, but it is equally notable in regions untouched by war. The increasing tolerance of religion in Russia is typical of a worldwide trend.

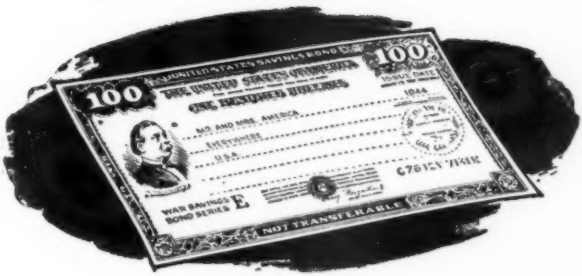
The probable course of religious development, however, may surprise many. Dr. Wheeler's cycle studies indicate rather clearly that if history repeats itself, as it has been doing for centuries, we may expect numerous new sects to arise. Instead of great new cathedrals, we are more likely to see an increase in little brown churches in the vale. Many of these churches may be devoted to denominations not now in existence. The coming cycle will probably be similar to the 1830's and 40's, when many new sects arose.

These new sects will stress simple faith and a God of personal experience. They will tend toward fundamentalism, without much stress on being one's brother's keeper. A resurgence of evangelism will be expected, with much hitting of the sawdust trail. Missionary work—which Dr. Wheeler reminds us is typically "cold" throughout history—will expand enormously. There will be little conflict between church and state, particularly since as the individual becomes more important, the state becomes less so. The Inquisition occurred during a hot-dry cycle—a typical time of persecution. The coming cold cycle is associated with freedom, tolerance, rebellion against oppression.

[*Continued on page* 140]

He won't dodge this-

Don't *you* dodge this!



The kid'll be right there when his C.O. finally gives the signal . . .

There'll be no time to think of better things to do with his life. *The kid's giving all he's got, now!*

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Cycles Predict The Future

[*Continued from page* 138]

These thumbnail predictions are based upon Dr. Wheeler's monumental studies which assume that cycles which have repeated themselves regularly in the past will continue to do so. These cycles in culture are intimately related to cycles in climate (see MECHANIX ILLUSTRATED, May) which affect human activity by controlling the energies of mankind. Dr. Wheeler reminds us, however, that cycle swings have been less extreme in recent history. He thinks it quite possible that we are approaching a middle of the road position.

Now is the time, perhaps, for the best points of warm and cold cycles to be blended. "The youth of today," says Dr. Wheeler, "may be able to sense the sound cultural contributions both of warm and cold epochs and effect a genuine and lasting fusion." But such a possibility may be temporary, for the latter part of the century—with several climatic cycles converging—may well bring extremes that have not been experienced for centuries.

Dominating culture trends for which we should be prepared, typical of cold cycles, include renewed interest in migration and exploration. It is the favored time for the adventurer, the individualist. It has been marked in the past by increased colonization and revival of world commerce. The chance to carve out a fortune should be better, with free trade ascending and the bureaucracy of government relaxing.

Relations between the sexes also show a typical cold culture pattern. Abnormal sexual behavior decreases, but there is an increase in prostitution. The romantic life is spontaneous and unrationalized, with an increase in birth rate accompanying a recovery in virility. This tendency toward larger familes may tend to modify the predictions of most sociologists that the U. S. is becoming an "old" nation—that is, the average age of the population is increasing. The present increase in the birth rate is a temporary wartime phenomenon which has already begun to diminish. But the current crop of babies will come to maturity at a time when the "cold culture" should be well established, and when these infants become parents they will probably have more children than their fathers did.

Human cultures are not static; they grow, reach maturity, and die to make room for their successors. Records of history correlated by Dr. Wheeler and other workers show that plant and animal life springs up and becomes highly differentiated during warm-wet epochs, starts declining during the warm-dry phase, and suffers extinction during the cold epoch. Human activities (which may be lumped under the broad term "culture") behave similarly, for they, too, are expressions of energy.

Where do we now stand? The beginnings of the modern world, Dr. Wheeler suggests, came out of the Renaissance when the last great cold-

Cycles Predict The Future

dry epoch centered on 1470. There is evidence that our culture is through the throes of a breakdown that will mark one of the great changes of history, comparable to the collapse of the ancient world in the middle of the fifth century, including the fall of Rome, and the collapse of medieval culture in the fifteenth century.

The cycle yardstick by which such a probability is measured is 510 years long. This rhythm is not arbitrarily arrived at; it is, indeed, the same 510-year cycle that repeats itself remarkably in climatic swings.

"Regularly since ancient times, there has occurred a breakdown in civilization associated with the termination of a corresponding climatic rhythm," says Dr. Wheeler. "The centers of these breakdown periods have been 450, 960, and 1470. Will the next one center on 1980? A vast array of facts points to this conclusion."

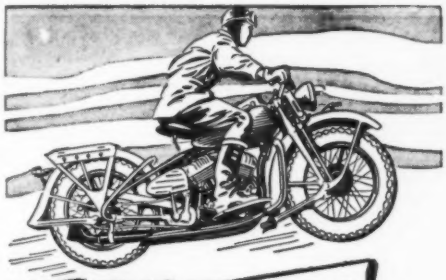
The facts which Dr. Wheeler has assembled are so extensive that it requires a book of some 2,000 pages to list them. The story they tell, however, is that during the first half of the 510-year cycle, great nations and cultural epochs are built up; during the second half they enter upon periods of decline. The center of the cold drought epoch should be 1980 if the present rhythm continues (Dr. Charles Greeley Abbot of the Smithsonian Institution, noted authority on weather cycles, also predicts a great drought period for 1975).

What we may look for in the decades just ahead is a period of cultural decline, civil wars, chaos, domestic strife, more democracy and local control, less centralized government. Wars, the rise and fall of nations, strife of minorities, the shifting balance of power between Asia and Europe—these, and innumerable other phases of culture which affect the group more than the individual, have for dozens of past centuries been affected by great cyclical swings and the probability is that they will continue to show such fluctuations.

If this is true, the world we are coming to will be excitingly different, and not all of its changes will follow the patterns which, from our present short-term point of view, appear inevitable. Sweeping onward to converge around 1980 are several potent cycles which may perplex the man who views present trends with enthusiasm, disturb the man who views those same trends with alarm, and surprise them both.

Will we have more government control or less? Will strikes increase or diminish? Will labor dominate? Will we have socialism or communism? Will Asiatic peoples threaten the West? Will there be future wars, and if so, what kinds? The probabilities, insofar as cyclic swings are painting them, will be presented in next month's MECHANIX ILLUSTRATED.

Half of the world's arsenic supplies are produced in the United States.



"I REMAIN, AN OLD HARLEY-DAVIDSON BUG"- - - - -

IT'S the way F/O George B., ends his letter that explains how Harley-Davidsons and motorcycling *get under a fellow's skin*:

"Am an American in the Canadian Air Force — served over three years as a bomber pilot in the African, Sicilian and Italian shin-dig, and am now back in England as an instructor. Have ridden Harley-Davidsons more than twenty years — they are the best. I firmly believe motorcycling experience helps a lot toward being a good pilot. There's a marked similarity in the way both machines handle. I still yearn for my Harley-Davidson which used to keep me in good physical shape. I will have saved more than enough to buy a new Harley-Davidson after this fracas is over. I remain, an old Harley-Davidson bug."

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HARLEY-DAVIDSON
MOTORCYCLES

Tomorrow's Air Transports

[*Continued from page 71*]

For the airminded, a more practical global center is the North Pole. The more practical routes are the "great circle" ones—lines that follow the curve of the earth's surface. Since 90 per cent of the people and most of the land masses of the world are located in the northern hemisphere, most of these great circle routes will arch over the top of the world, across the Arctic region and sometimes smack over the Pole itself.

Pathfinder for these new third-dimensional routes is the greatest global airline in the world today—the Air Transport Command of the Army Air Forces. Hacking their way through jungles and levelling Arctic glaciers, the engineers of the ATC have built a globe-circling network of airways—a job which took little more than a year and, in the opinion of General George, "makes the construction of the Panama Canal look like small peanuts." In its first year, this "aerial cannonball' service raised the daily volume of American airborne cargo from 30 tons to 150 tons. The record has since been repeatedly shattered.

Today 17 different airlines are operating under ATC orders, covering global routes that total more than 150,000 miles. It's now a commonplace occurrence for an ATC pilot to fly overseas and back to the States again within the day. In the time it takes you to read this article, ATC pilots will have flown enough miles to compass the earth. By the same time tomorrow they will have girdled it 120 times.

Military questions apart, the ATC has, in effect, ushered in the Air Age. It has mapped the shortest routes, laid out the airways, built the round-the-world bases. When it retires from the scene after the war, the commercial airlines will take over. There will, of course, be a spirited scramble among the big nations for control of the new airways. Discussions are already under way between the Allies about aerial spheres of influence and division of air bases. The British Miles "X," a super stratoliner illustrated on these pages, is one of England's chief bids for postwar air power. The Consolidated Vultee Model 39 is one of our own potent claims on peacetime airlanes. Competition in this new sphere will undoubtedly be lively.

However the contest resolves itself, you can look forward to luxurious accommodations for air travel on a scale never dreamed of in the days of two-dimensional transport.

For one thing, the air will be as safe as any other travel medium. Even today, with all its vast and far-flung operations, the ATC has suffered the unbelievably low losses of 1/400th of one per cent, according to General George. That's safe travelling in anybody's air—war or no war.

And many of the bigger cities of the Middle West will experience a great resurgence, since they lie athwart the best air routes. Via the Arctic it's considerably closer to many points in Europe and the Orient from Chicago, Kansas City and Omaha than from New York and San Francisco. Our coastal areas may lose their strategic importance as the country's interior is covered by intermeshing strings of airports.

Aerial transportation experts state that most of the fighters and bombers developed by the Allies will not make first-rate peacetime transports when converted after the war. They are warrior planes and as such were designed for highly specialized destructive purposes.

It seems more likely that the postwar air will be filled with tried and true transport designs such as were built by Boeing, Douglas, etc., for commercial airlines like T.W.A., Eastern, Pan-American, United—before the war. Many of these safe, sane, beautiful planes took off for the Allied war effort when aerial transportation was so badly needed. The story of the mighty Lockheed Constellation, the 55-passenger record breaker that makes Honolulu from California in half a day, is the story of T.W.A.'s foresight tying in with crucial Army needs. And the Douglas Sky Master saved a critical situation for the British in Egypt by flying in vital ammunition.

Little need be said about the Martin Mars, the giant winged boat that recently flew 148,500 lbs. from California to Pearl Harbor nonstop.

These are the transports of now and tomorrow —with certain improvements and refinements and additional luxuriousness. From the commercial viewpoint remember the axiom—heaviest load over longest distance in shortest time with greatest safety at least cost. Add to this superior passenger comfort as in the projected British Miles "X," or our own Consolidated-Vultee 39, and you'll have the lowdown on what will take passengers and cargo high up in tomorrow's air transports.

Today the skies are streaked by the vapor trails of cloud-skimming bombers and military transports. It's the "real beginning of the air war" that we're catching a glimpse of right now. Tomorrow armadas of sleek, lumbering giants will be buzzing through the stratosphere—bent on the pacific mission of enriching your daily life and widening your horizons.

Dive Bomber Gunner

[*Continued from page 76*]

and Wake, at Kwajalein and Saipan, and at Rabaul, Bougainville and Truk.

From Hawaii we set out again at the beginning of this year and headed west. On the 16th of February we took off from our carrier in Majuro Bay to bomb Truk. It was an hour after dawn. A 70-plane fighter sweep had gone out an hour ahead of us to do some preliminary strafing and to engage the enemy fighters. Sixteen planes of our squadron had the job of bombing the Jap ships in the harbor or Truk. After flying an hour

and a half at 10,000 feet we saw the island rising up ahead of us. It was a perfect day, but there were too few clouds for the best cover.

As we got over the big harbor we ran into a hellish amount of AA fire from the dozens of ships down below. I didn't have time to count them but I saw cargo vessels, tankers, destroyers, and cruisers. Our formation of three picked out a cruiser and pushed over into a dive. The flak followed us all the way down. Mr. Davidson released the bomb at about 2,000 feet and pulled out of the dive. I saw the bomb explode in the water right next to the ship.

We flew low over the harbor so no Zeke could get under us, and went through a hail of flak from barges in the water equipped with 20 mm. guns. I heard a tremendous explosion from an ammunition dump that had been hit. A huge red ball of fire rose above it 2,000 feet in the air. I heard later that the pilot who had dropped the bomb on the dump was caught in the mountain of flame that he created.

As we rose above the harbor to rendezvous with the rest of the squadron, I saw one of our fighter planes in the water. As I watched, a scout observation plane, an OS2U, landed in the water to pick the pilot up. A Jap destroyer opened up on the rescue plane and it looked as if it would be hit before it could save the stranded pilot. But six of our fighters, seeing what was going on, swooped down on the destroyer and strafed it. That kept the Japs so busy that they couldn't pay any more attention to the rescue plane, which took on the stranded pilot and got away with him safely.

We rendezvoused with the rest of the squadron and flew back to Majuro Bay, reaching the ship about eleven. I had time to grab a sandwich and a cup of coffee before we were called to the briefing room. Our scouts had reported that three enemy cruisers were steaming down the channel leading out of Truk trying to escape. We had to get back there right away and stop them in their tracks.

Sixteen bombers went on the second hop with the same number of fighter escorts. We rendezvoused just before getting to Truk about noon and flew in. We had to scout around to find the cruisers, but we caught up with them ten miles outside the harbor. They were tearing through the water at full speed, weaving very prettily in and out and making themselves hard targets to hit. We got over them and circled three times, getting into position for our dive. The flak was very heavy and much too close for comfort—their ship AA is a lot better than their shore batteries. It was so close that I could see it burst-

[*Continued on page* 145]

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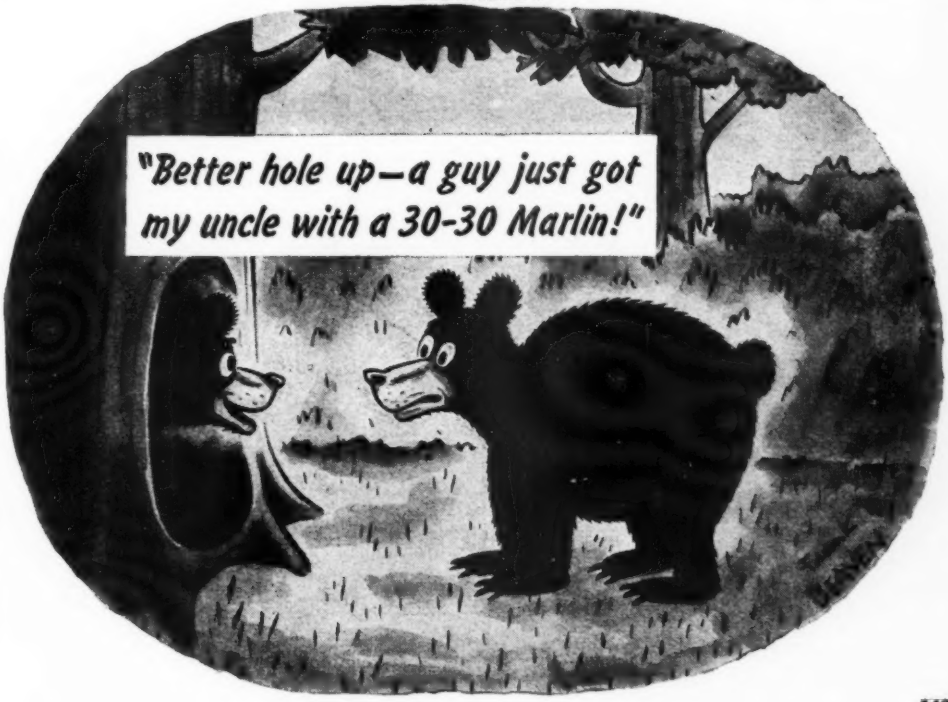

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(pages 26-32)

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Tackle For The Troops

[*Continued from page 79*]

fishing kits a week. Each week their efficiency increases and they keep topping the previous week's figure of kits turned out, which, to date, is well over 1,000 complete kits a week.

Getting the right type of tackle to the various fishing enthusiasts overseas is Harlan Major's department, and he knows from personal experience just what fishing problems they're up against. Back in the days when pleasure cruises carried carefree vacationists to all parts of the world, Harlan Major's work, if you could call it that, consisted of developing game fishing in new and untried parts of the globe for governments and transportation companies. In this capacity he has fished the Coral Seas around Wake Island, Guam, Hawaii, the Philippines, the trout streams in the Aleutians, and most of the European waters.

Today, with these waters definitely closed to civilian fishermen, Major's sole pleasure is seeing that our hobby fishermen, now fishing for Japs and Nazis in these areas, have the means by which to relax and enjoy a little fishing during their breathing spells. At least one general took time out during the preparations for the European assault to whip a stream in the Atlas Mountains of Africa, and it is no uncommon sight to see soldiers fishing over the sides of ships during an actual battle.

Letters pouring in from these grateful boys are a particular delight to Harlan Major. Since he accepts no payment for his services or equipment, one happy marine offered to repay him by getting a Jap for him. Another related, almost tearfully, how he lost his favorite plug. He hooked a wahoo one day and the mess sergeant excitedly swung a hammer at it, missed, hit the line instead, and broke it.

Individual soldiers overseas, asking for fishing tackle, get simple kits, adequate for their needs. More complete equipment, rods, reels, lures, etc., goes to recreation officers, Red Cross, and U.S.O. centers, who check it out to different men every day, thereby permitting the greatest possible number to enjoy the sport.

So great is the call for fishing tackle, that Harlan Major and his fishermen often work far into the night getting out the equipment on schedule. Before he can get it out, however, he must first get it in, and that is where every sportsman can share in this great morale-building enterprise by sending along his surplus tackle and fishing paraphernalia to Harlan Major, 115 East 35th Street, New York City. He and his volunteer helpers will see to it that it is put into first class shape and sent to the boys who really can use it when they need it most.

By bombarding Uranium 235 with high speed atomic bullets, University of California physicists have succeeded in dividing this heavy element into two equal parts—another step in research which may lead to obtaining atomic power.

Dive Bomber Gunner

[*Continued from page* 143]

ing around us as we dived. The bomb landed off the starboard side amidships—a very near miss.

The torpedo planes followed us in. They came in from the side, low and fast, and dropped their fish. I saw one of them hit. It made a big explosion. I hadn't seen anything like that in a long time.

We went back to the ship right away and had a rest for an hour and a half before we went out on the third hop. This time we were going after the land installations, hoping to mess up their airfields so they couldn't come after us in the night. We reached the islands for the third time that day about six, with an hour of daylight left. The flak was worse than ever. We spotted our target, one of the airfields, just a strip wedged in a valley between two mountains. We had to dive down the mountain sides to get at it.

It was almost dark when we got back to the ship about 8:00. During the night Jap "Bettys"—torpedo planes—chased us but didn't do any damage. We figured that those planes had come from the Marianas because we had shot up most of the planes at Truk.

The worst time we had with the Bettys was after bombing cargo ships in the harbor of Saipan. That attack, which we made after Truk and just before we came home, was a pushover. There was very little enemy opposition. We just dropped our bombs and left, but during the night the Bettys swarmed all around us. The mufflers of those planes are masked so that they don't show any tell-tale fire, and the planes are lacquered all over to make them smooth and offer as little resistance to the wind as possible. I've seen them when they've been shot down. Even through the dirt you can see the shine of their smooth surfaces.

The Bettys come at you on the beam, flying in low over the water, dropping their fish as close as they can, and skimming away. I've seen them come through the heaviest AA fire. Five of them attacked one of our AA cruisers that are loaded down with 5-inch guns and can put up the heaviest barrage of any one ship. The Japs made the mistake of attacking one at a time, so they were picked off easily; but they kept on coming.

Well . . . it's swell to be home. I have the Purple Heart for Rabaul and they tell me I've been recommended for the Air Medal with two stars. We saw a lot of action in seven months, but I'm looking forward to a month's leave. I wouldn't mind some duty here in the States after that, but if I have to go out again, I'd just as soon go as a radioman and gunner. It's sort of hard to explain why, but I want to stick to it.

Using a two-way speaker system, Iowa school districts are bringing school to more than 100 crippled children at home, so that they not only hear a teacher but can recite and be heard by the class.

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Your Invention Clinic

[*Continued from page 14*]

"a process to do a definite job although something tangible would be lacking."

ANSWER: *Your question is rather ambiguous and difficult to answer. It is not absolutely essential that a certain machine be protected. A principle can be covered, but there must be a specific and avowed purpose, and in sufficient detail so that those gifted in the art could duplicate your results.*

You could not protect a machine for drilling holes, because there are hundreds of ways to drill holes; but you might be able to protect a specific type of mechanism for drilling holes, for example, a mechanism which would drill holes by high-frequency currents and a blast of compressed air to blow out the hole. It would not be essential that you protect both the electrical device for producing the high-frequency and the mechanical parts of the air compressor.

In our opinion it might be better for you to establish some sort of priority and then get some competent opinion on the merits of your system before you go haywire on a patent application, which might prove useless or too costly to operate.

Telephonic Fire Alarm

Oliver H. Fritz, La Crosse, Wisconsin, submits a design for a fire alarm system connected directly into the telephone circuit. He wants our opinion.

ANSWER: *There is nothing new in your fire alarm. You require an attachment to the telephone, which must be coupled in directly on the telephone circuits and the only thing it does is to give a signal at the switchboard or at the central station. The operator would not know whether this is a fire or whether someone left the receiver off the hook or broke the circuit in some other manner.*

A much more elaborate system has been developed, and models have been built and demonstrated. This unit calls for no changes in the telephone circuits. When the alarm circuit is closed the telephone receiver is lifted from the stand automatically and a phonograph record delivers the following words: "Operator, there is a fire at——Zero Street. Please notify Fire and Police Departments." This record is repeated over and over again, until parts of the mechanism are burned out by the fire.

We believe that this system is better than yours, hence we advise against further procedure with your design, because it is doubtful that you could induce telephone companies to install it.

Ink Bottle

Borden Jones, Toronto, Canada, intends to use a shoulder abutting stopper on ink bottles.

ANSWER: *We can't see how your ink bottle top*

will prevent ink from getting on the fingers. The ink would certainly drip down and cover the glass and will then be picked up by the fingers directly from the glass.

Many of the large plastic knobs which seal the tops of modern ink bottles are provided with a sort of internal cork, which stops the flow of ink at the lip of the bottle instead of at a shoulder. We believe that lip seal is superior to your design.

Swing Window

Andrew J. Takash, Little Creek, Virginia, asks for an opinion of a house window—the nature of which is made clear in the reply.

ANSWER: *In your design for an improvement in the modern window what did you do with the present rails—remove them? If so, how do you keep the windows from blowing inward during a storm or wind?*

If you section the window so that it swings on gliders, you have added nothing new. There are many similar types available. Most of the popular ones are those which swing at the center either across or vertically.

To our mind the modern window is more or less stupid in design. An architect cuts a large hole in the wall. He fills this with a window sash, only half of which can be opened. The other half dissipates a great deal of heat and gives no light because, the lady of the house covers the window with curtains, pulls down the shade half way, and makes less than ⅛ of the window available for sunshine and air. In the wintertime, when sunlight is needed indoors, the windows are covered further with heavy drapes.

The French-style of windows is much more practical. Some of these have been designed so that they pivot almost at the center, close tightly, and can be reached from the inside for cleaning on the outside.

Before we can give you more specific advice on your design, we would require further details. Meanwhile, no action is indicated.

Variable Electrode Spark Plug—Rotary Valve

Norbert Janosky of E. St. Louis, Illinois, asks about a spark plug with a movable leg; also inquires about a rotary auto valve.

ANSWER: *In our opinion a movable electrode to serve as the ground leg of a spark plug is an absolutely worthless idea. This electrode would have to run through a tight bushing where you will introduce one more place for leaks and wear. Pitting and burning of the rod in the cylinders will take place. Another disadvantage is that a spark will fly just as soon as the electrode comes*

[*Continued on page* 148]

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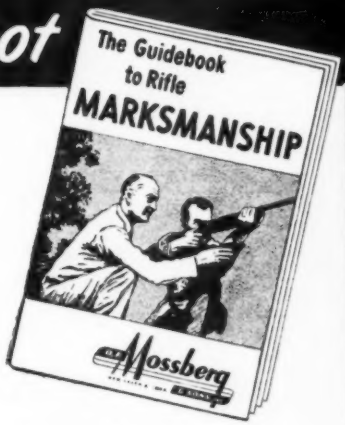

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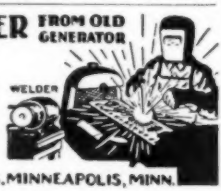

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Your Invention Clinic

[*Continued from page 147*]

close enough to rupture the gas envelope between it and the other live leg. No action is indicated.

Many dozens of rotary valves have been designed for use on automobile and aircraft engines. None of these has been put into practical service, with perhaps the exception of the Willeys sleeve-valve motor, now a thing of the past. There were two types of Willeys valve. In one of them there was slight rotation and a sliding movement at the same time, which operated for both intake and exhaust cycles.

A search will reveal that a great many other rotating valves have been designed, and you would probably find it extremely difficult to get any kind of patent protection. Consequently, we aavise against such action.

The Gunners Had The Fun

[*Continued from page 37*]

went on—the 10,000-ton Norfolk baring her fangs in hot pursuit of the 26,000-ton Scharnhorst. The action and chase together lasted from 9:30 a. m. until 7 p. m. There was, of course, no time for regular meals down there in the engine room where oil and sweat mixed to produce what it takes to keep a damaged battle-wagon going. The men were sustained on gulps of soup, hasty gnaws out of sandwiches, concentrated food tablets and, naturally, the omnipresent cup of tea.

The performance of the men below did not go without the proper accolade from their officers. Engineer Lieutenant-Commander R. C. H. Reed, R. N. R., was especially struck by the conduct of a fledgling rating who, until the war broke out, was a North of England farm lad. "He's still only about 19 years old," says Lieutenant-Commander Reed, "but although we were half suffocated by the fumes, he just leaned on the rail in front of the indicator dials and recorded every movement for hours as if nothing had happened or was happening."

The ultimate tribute, however, came from Capt. Bain himself. "We did not have to drop out," he said, "and we were there for the final phase of the action, which gave all the sailors intense delight." Including the men below—when they heard about it afterwards.

The U. S. Bureau of Mines has contrived a mechanical house shaker, to study vibration hazards that blasting causes to nearby buildings.

Statistically interesting—the United States could move its entire population at one time, in comfort, in its 26,000,000 passenger automobiles.

To revive the Western Hemisphere's rubber industry, high yielding stock is being planted in government nurseries of 10 countries.

Bombs vs. Shells

[*Continued from page* 46]

be set off by the friction of the pin. But while the explosion of this cap is violent it would still be too weak to set off the HE. A larger explosion is needed to do that. So the percussion cap sets off a small charge called the detonator. And since even that might not be enough the detonator sets off a comparatively large powder charge which goes under the name of booster. Explosion of the booster charge finally sets off the demolition charge—the whole process taking only a small fraction of a second.

This is only the "outline" of the fuze. It consists of many more parts; in fact, the fuze is a more complicated mechanism than the whole bomb. The other fuze parts can be classed in two groups, one headed "safety" and the other headed "delay." The safest HE would be useless if the fuze went off prematurely. Hence there are numerous and varied safety features in the fuze which prevent it from functioning because of accidental rough handling or a similar reason. While these safety features are designed to protect the men who handle the bombs, the "delay" features are designed the better to harm the enemy. If a bomb with a fuze as described fell on top of a five-story brick building the HE charge would explode before the bomb even penetrated the roof. The explosion then would take the roof off.

This is good enough if you cannot do better. But it is easy to do better. Just see to it that the booster charge explodes a second or so after the percussion cap instead of practically simultane-

[*Continued on page* 150]

"This must date back to 1943—he's clutching a pound of coffee in his arms."

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Bombs vs. Shells

[*Continued from page* 149]

ously with it. In the meantime the bomb has crashed through several floors. Then the explosion will take place in the middle or even on the ground floor of the building and blow the walls out. The building will collapse, unless it has a steel frame, which European buildings do not have as a rule.

So much for bombs; now the shells.

A shell fuze functions the same way—it has similar safety features (the fuze cannot function until after the shell has been fired) and it has a similar delay mechanism (unless a particular shell is supposed to be instantaneous). The HE charge also consists of TNT most of the time. The body is drawn of tough steel and made so that its front fits precisely between the ridges of the rifling grooves (called "lands") of the gun barrel. This precisely fitting portion is called the bourrelet. The copper driving band in the back fits the bottoms of the rifling grooves.

So far, shells and bombs sound alike. Where are the differences?

One important difference is this: the HE charge of a bomb is roughly half its total weight. The HE charge in a shell is only from 10 to 15 percent of the total weight. That sounds as if things were in favor of the bomb, but matters are not that simple. If it comes to the smashing of structures which are not too solid, like the average run of European apartment houses, light factory buildings, etc., the higher HE charge is an advantage. If it comes to field use it is not. In 1920 a major of the British Royal Artillery began a lecture to fellow-officers with the words: "Gentlemen, I am sure that many of you, like me, owe the fact of their presence to the fortunate circumstance of having been fired at with German high-capacity shells. . . ."

The point of that remark was that high-capacity shells had too large an HE charge, which blew them into splinters so small and light that they could not travel far against air resistance. The comparative capacity of a bomb is still higher.

It would seem then, one might think, that shells are preferable against troops in the field and bombs against structures. The first part of that sentence is correct, the second is not. There is the little matter of penetration to be considered, especially if the structures under discussion are solid fortifications and not just peacetime houses. Penetration is a matter of impact velocity. Now a bomb, falling from 20,000 feet, strikes its target with a speed around 900 feet per second. The bomb of a dive bomber strikes with a speed around 500 feet per second. A heavy shell, say from a battleship turret, will arrive with a velocity of about 2,500 feet per second, more under certain conditions. Penetration goes up with the square of the impact velocity, so that the shell that arrives three times as fast as a bomb will have about nine times the power of penetration. (This explains, among other things, why bombs failed to harm those enormously massive German U-boat pens as much as some people expected.)

Bombs vs. Shells

So if it comes to especially heavy structures or to actual armor plate the odds are all with the shells, while they are with the bombs if city structures are to be destroyed. The odds are even more with the shells because the accuracy of shell fire simply cannot be matched by aerial bombardment, no matter how highly publicized the bombsight. On the other hand the bomb has a "range" of a few hundred miles, even of a thousand miles in exceptional cases, while the range of a shell is a matter of miles only, 20 miles being about top limit for extra-heavy guns.

It has become clear by now, I hope, why bombs and shells cannot be compared. Both explode and are similar in their make-up, but thereafter any similiarity is more or less superficial.

But there is a last difference to be considered: volume.

A 1,000-plane raid, loosing 2,000 or even 3,000 tons of bombs upon an enemy city, appears to be the ultimate in devastation. But, as a matter of fact, artillery has done better. During the heavy aerial pounding of Germany from January 1st to March 31st of 1944 the RAF and the US Air Force dropped an average of 1,300 tons daily on Germany. This is, I repeat, the daily average for a heavy air assault upon a country. During the last three months of World War I, during a front-wide land assault against a country, British and American artillery fired an average of 11,500 tons of shells daily, eight times the weight of the daily air-war average.

Or maybe you like to compare a single action: 3,500 tons of bombs were dropped on Cassino on March 15, 1944. On July 31st, 1916, the British artillery opened up with massed guns at Ypres, firing 23,000 tons of shells. So far the Russians have not released any figures about the total weight of the artillery barrage that lifted the seige of Leningrad or of the artillery and rocket barrage that relieved Stalingrad. In both cases the weight of the heaviest air raid must have been surpassed by far. In both cases each shell that hit, hit a trained soldier, not a chance civilian who got in the way. Each shell that destroyed something destroyed fortification or war structure, not some factories along with apartment houses.

You cannot compare the two weapons. In the field, artillery is decisive. Elsewhere bombs do the work because of their longer range.

The British army is undertaking an agricultural program in which the army will cultivate available land.

British corvettes built to chase submarines are smaller and cheaper than destroyers and require a crew of only 50 men.

China is paying the four loans received from the United States since December, 1938, in shipments of tungsten, tin, antimony, and wood oil.

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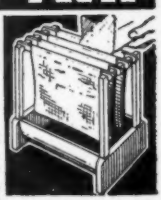

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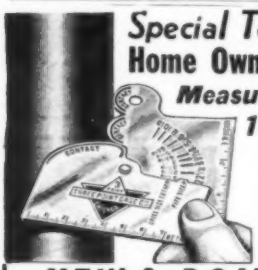

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Continent Of Tomorrow

[*Continued from page 52*]

million or so square miles of next to virgin territory, variously known as Matto Grosso, the Oriente, and the Amazon regions. For the next 50 years at least, they will be the most speculatively interesting territory left on this sophisticated globe.

Until comparatively recently, tales of travelers and explorers have thrown a veil of horrific legend over Amazonia, for example. It was not all myth. There were very real perils: savages, poisoned arrows, reptiles, impenetrable forests, dismal swamps, and most fearful of all, yellow fever and malarial mosquitoes. Even the British, who had obtained the exclusive right to enter the region a hundred years ago, made only a few feeble attempts to exploit their profitable monopoly.

Now, however, within a decade, the whole Amazonia outlook has been completely changed! Two alterations in the previous helter-skelter methods of tackling the Amazonian jungle and attempting to exploit it have been made. First, even the smallest expedition is scientifically planned; second, recent inventions and discoveries together remove practically all of the former perilous hazards. Whereas explorers and *seringueiros*, or rubber gatherers, used to go into the deep jungle fatalistically, wondering whether or not they would survive, nowadays they take a few shots in the arm, lightly load up with dehydrated foods, and take along a walky-talky outfit so they won't get lost. They find it was not so much the barrier of the jungle as the pall of dread and unpreparedness together that finished them off.

Just a little farther down the line from Rio is a Brazilian state only a quarter as large as Amazonia, but with a population twenty times as great. Its name is Minas Geraes, which means "General Mines." Name any valuable mineral and you will find it in Minas Geraes.

First, it has the largest deposits in the world of iron, which in both war and peace is respected more than any other mineral. Gold we could get along without, but not iron. Twenty-three per cent of the world's store of that most common and yet most precious metal is in Minas Geraes. In the days to come when the nations of the world will have to turn about and build up all they have torn down, Brazil will get her share of providing this vital material. With this in view, the United States has cooperated splendidly by shipping iron and steel works complete to Brazil. The need will become acute for men with engineering and technical experience and ability to undertake the huge iron and steel tasks ahead.

But Minas Geraes has a heart of gold within her breast of iron. Gold is to be found in quantity all over this country, most of it from alluvial sources. The number of independent "panners' getting gold out of the earth exceeds 25,000. Their

Continent Of Tomorrow

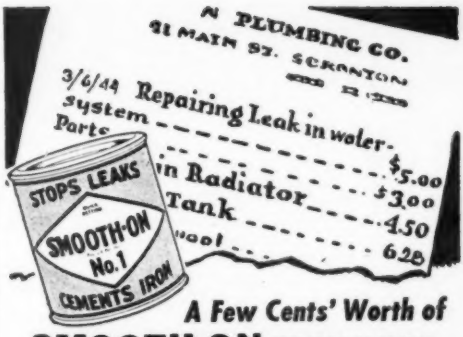
average daily yield is 4 grams of fine gold, which is not half bad. Every once in a while one of these placer miners makes a "strike," which is like winning a lottery.

"General Mines" does not stop with iron and gold. There is also silver, nickel, tin, manganese, chromium, etc. Brazil is a world leader in the production of nickel. In manganese, she competes with Russia, British India, and the Gold Coast. Whenever lead is unearthed, it shows a percentage of silver higher than 150 grams to the ton! There are square miles of beauxite, piled up and ready to be washed and reduced to aluminum.

Finally, precious stones are to be found in many corners of Minas Geraes. Brazil is the sixth diamond producing region in the world. Besides, you may be fortunate enough to dig up topazes, aquamarines, tourmalines, garnets, zircons, rubies and rock crystal.

One finds it hard to speak temperately of the products of Brazil, they are so varied and so rich. In quite a different way, there is nearly as much opportunity lying around loose in the big cities of Brazil as out on the lands. While most South American countries are one-big-town nations, Brazil has a dozen cities of 100,000 or over. You will have no difficulty going places, because every sizable town, far or near, has an airport with good service.

With a population of 43,000,000, Brazil is not only the biggest and richest country in our hemisphere, but the most fabulous and glamorous land on the globe. For the most part, it is a land waiting to be discovered and crying to be explored. It offers opportunities for those who are willing to adapt themselves, not only to the Brazilian climate, but also to Brazilian customs. If you want a career in Brazil, plan to make friends with the people. It will not only help you in your work, but also make your life there much more pleasant. The Brazilians are a proud and sensitive people, and they are deeply resentful of the old type of American who treated them as inferiors. There is no place in post-war Brazil for that type.



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Wagon With Wings

[*Continued from page 65*]

This arrangement gives 2½ feet of extra headroom.

The good doctor admits that some planes may be lighter than his Conestoga, but he says that in its weight class it probably is more efficient than any other craft now operating. "It's like prizefighting," he points out. "There are heavyweights and lightweights. The heavyweights stand up better. It's like automobiles, too. You can't compare a Ford with a Cadillac, can you?"

As for construction costs, he says that Budd's "shotweld" process is far faster than the most improved riveting techniques, and therefore more economical. Perfected for the great steel sheets used in fabricating railroad cars, "shotwelding" makes great use of trigger-sensitive machines that appear to do everything but give out the telephone numbers of the girls who run them. Watter describes the process as "spot welding with controlled timing."

In the Conestoga are more than 1,500,000 individual welds, 90 per cent of them machine-made. Tkeir vast number is responsible for the plane's slightly wrinkled appearance—her skin looks like tinfoil that has been crumpled and then smoothed out.

To return to Conestoga features that make pilots happy, there is her low stalling speed: 65 m.p.h. under full load. Her wingspread is 100 feet, her overall length 68 feet. She will cruise at 165 m.p.h. and can reach 200. Admittedly this speed will take nobody's breath away, but in telling Budd what was wanted the Navy did not emphasize fast travel. What the strategists demanded was a transport that could get in and out of South America's rough, small fields—and also those on Pacific islands.

Dr. Watter, with generous use of wing flaps, has given the government what it sought. The Conestoga becomes airborne with a run of only 920 feet under full load.

Because the Navy's plans did not call for more, the Conestoga's range with full load is only 650 miles. Maximum range with present tanks and no load is about 1,700 miles. Through the use of auxiliary tanks, for which provision is made, this can be increased to 3,500 miles. The skytoughie requires a crew of only two: the pilot and co-pilot. Their quarters are in the roomy, comfortable, full-height knob that gives the Conestoga her bullhead look.

When the Conestoga was first projected, America did not have its present great supply of trained pilots, the U-boat packs were in full cry, and it was hoped that the plane would be one which a man of limited experience, perhaps without any dual-engine training whatever, could handle. Dr. Watter thinks the Conestoga is that type of machine. "Even a little boy could fly her," he smiles.

While primarily a cargo carrier, the Conestoga can become a troop transport or ambulance plane

Wagon With Wings

in a matter of minutes. There are facilities for 24 soldiers and 24 stretchers. The Conestoga could launch paratroopers in concentrated numbers because she has doors in both sides of the fuselage, whereas conventional transports have but one door. It is not inconceivable that while troops went out the side doors, supplies could be dropped through the hatch which, when opened in flight, does not seriously impair maneuverability.

Until the day when the Axis has been pounded into accepting realities, the Navy is going to find

"Der Fuehrer says only rats will desert their ship. Which one of us rats is going to jump first?"

plenty of use for the stout-hearted Conestoga. But what about the postwar outlook?

Budd makes no all-encompassing claims for stainless steel aircraft and is quick to concede that other metals are not now to become obsolete. But the company, which has seen the gleam of its steel on railroads that once scoffed at the dreams of Edward G. Budd, feels that the need for short-haul carriers will prevail after the guns have quieted.

In any event, a Conestoga is again traveling pioneer trails.

Laminated collars are a result of experiments in fusing fabrics.

Fossilized pollen will be studied by University of Oklahoma archaeologists in hope of dating more definitely, burial grounds and other traces of an Indian civilization believed to have flourished in the State about 450 A. D.

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(pages 26-32)

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Editor's Workbench Chips

[*Continued from page* 16]

there's the undeniable fact that technical training has been vastly curtailed because of the war: 98 percent of our civilian engineering students have been drafted.

A warning note was struck by many of the personnel experts who took part in the survey. There may very well by an over-supply of trainees from Army and Navy "condensed" technical courses, who will need further training before they can compete with regular engineering graduates. Already many colleges are whipping postwar courses into shape that will round out the professional schooling of such trainees. The general idea for incipient technicians now in the service would seem to be this: make a beeline for the classroom as soon as the shooting's over.

KAYAKING ON LAKE BRENNAN

H. W. Hopkin, of 7471 a St. Denis Street, Montreal, Quebec, is the builder of this trim kayak. "The enclosed picture," writes Mr. Hopkins, "will give you an idea of the enjoyment my wife and I have from the 15½ ft. kayak (Nor'wester) built from your December, 1941, issue of MI."

It's a very neat looking job, and brings its builder a $3.00 Workbench award and a Certificate of Merit.

New One for Woodworkers

Professional and amateur carpenters alike will find a very useful tool in a new woodworking Calculator recently devised and placed on the market. Designed to help the craftsman solve many of the irritating problems liable to pop up on the job, the Calculator carries much valuable data in condensed form. It's shaped like a circular slide rule and is very simple in operation. By merely adjusting the dial you can convert linear to board feet, determine slope per foot in degrees, find comparative hardness, weights, shrinkage, warping tendencies and working ease of various woods. Bit sizes for head, body and thread of standard screws, nail specifications and tips on tool sharpening are also included, and just to round the thing out it's an accurate protractor as well. The Calculator is made by Greenlee Tool Co., Rockford, Ill., in case you're interested.

P.S.: Unfortunately, the Calculator *does not* cook or sweep out the office.

Editor's Workbench Chips

COMING NEXT MONTH

The School Shop

Do you know how to bail out of a plane? Next month's Aviation Lesson No. 19: Hitting the Silk, will tell you how it's done, and also tell you all about parachute construction, inspection and packing. It's stuff you had better know if you intend to do any flying, and few of us aren't in the postwar world. The Caterpillar Club is expanding its membership daily, and who knows? Maybe some day you'll be invited to membership.

"I could have bailed out, you know, but I wanted to save the ship!"

The Truth About Air Power

Is the mighty air offensive over Europe a success? Does the bombing attack on Cassino mean our Air Forces have failed? Here's a careful and authoritative evaluation by William Kimball of how powerful air power really is, on the basis of the latest facts.

Open Sesame

Sgt. Laurence Lader gives you an interesting picture of the locksmith wizard, Barney Zion, who rushes in where FBI and municipal detective-force experts fear to tread.

[*Continued on next page*]

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Editor's Workbench Chips

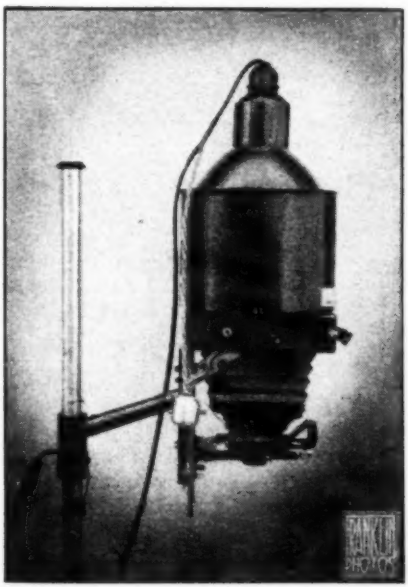
[*Continued from previous page*]

Peasant Pleasantry

When you open your September MI to the 4-color section on page 67, you'll get a visual treat—and some very useful ideas, for your home. Here, illustrated in full color to bring out the real beauty of his work, is the story of Peter Hunt, famous Provincetown (Mass.) artist and decorator who has practically removed the word "junk" from the dictionary.

Peter Hunt has been responsible for the latest and most attractive note in modern furniture decoration—the application of bright European peasant design and color to drab, worn out pieces, giving them new life and charm such as they never before possessed. Best of all, Peter's technique is so simple and elementary that you can easily do it yourself and turn those dingy old chairs and tables into gay, lively furniture that will be the envy of all who see them. Ingenious conversion of useless, dated or broken pieces into something you'll be proud to own is also described—a la easy Peter Hunt alterations. Be sure not to miss "Facials for Furniture" in the next month's MI—it's your chance to have a more attractive place at practically no expense.

PHOTO ENLARGER



Mr. Clifford G. Franklin of Shoals, Indiana, made this excellent enlarger from plans published in Photography Handbook No. 7. It features a removable light house reflector for use as a photoflood unit, and an arrangement whereby the camera attaches directly to the enlarger bracket, making possible its use as a copying stand. Mr. Franklin has been awarded a $3.00 Workbench prize and a Certificate of Merit for his project.

Editor's Workbench Chips

Dropping 'Em on the Doorstep

This is a gripping account by Richard Hanser of the most ticklish and exacting bombing mission ever handed an AAF airman—the pinpoint attack on one particular Gestapo building on a certain street in a certain Dutch town.

Power Tool

Would you like to have a heavy-duty jigsaw in your shop, without running all over town trying to locate a doubtful second-hand tool? Impossible? Not at all. Just follow the detailed plans and instructions for the Home-Built Jigsaw starting on page 94 of the September MI. It's a dandy, and you'll have no trouble making it.

Everyman's Postwar Car

You've heard and read a lot about the super-duper streamlined, jet-propelled, what-have-you postwar automobile; you've seen models, drawing and advertisements of transparent, plastic eggs on wheels (usually with no visible sign of doors or other means of getting inside) that are going to revolutionize travel in the future. Some of these fantasms even fly through the air with the greatest of ease, double for a submarine or burrow in the ground. According to reliable sources in the automotive and metals fields, however, most of these visions are just visions, and likely to remain so for a long time, if not forever. Now MI brings you, through Fred Russell, its automobile expert, a conception of what the medium priced postwar car is *actually* liable to resemble, based on surveys made among leading manufacturers in the industry. There will be improvements, refinements and modifications, but Everyman's postwar gas buggy isn't going to be so radically different from the last prewar models, at least not for awhile. Don't miss this interesting, illustrated article in the next issue.

GARDEN TRACTOR

Mr. Lloyd Tibbitts of Waterloo, Iowa, has turned out two nifty garden tractors, one of which, a riding type, is shown above. It can be used for harrowing and can pull a 10" plow. The other, a walking type, is handy for cultivating between the rows. Mr. Tibbitts has earned a $3.00 Workbench award and a Certificate of Merit for his excellent work.

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Popular Patents

Seeds Coated With Adhesive Envelopes

Means for making seeds more efficient, are covered by U. S. patent 2,313,057, granted to Albert C. Fischer of Chicago.

The invention, briefly, is a simple method for making each seed carry into the soil a small provision of fertilizer, fungicide, insecticide and (in the case of legumes) nitrogen-fixing bacterial that it needs in its first day or so after germination. This is accomplished by coating the seed with a water-soluble glue into which the initial lifeneeds of the seedling-to-be are impregnated.

To protect the seed against possible ill effects of too-long contact with fertilizer and fungicidal compounds, it is first covered with a coating of neutral glue, then with one or more coats containing the chemical and bacterial growth aids.

Enameled Pistons Cut Knocking

Enamel coating on the face of a gasoline engine piston, and on the inner surface of the cylinder head, will materially reduce knocking and also minimize the formation of "shellac" or "varnish" on the pistol skirts and hard carbon on the pistol head, states Frederic H. Emery of Bedford, Ohio, in the preamble to patent 2,311,039.

To the glassy enamel, containing cobalt to make it stick better to the iron, the inventor also adds alumina or other refractory substance to increase its heat- resisting properties. The enamel, usually, though not necessarily minus the refractory, may also be applied on the underside of the piston and on the radiating fins of air-cooled motors, to speed up transfer and dissipation of heat.

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Popular Patents

News of Nylon Tires

Those new tires you are going to get, after the liquidation of the firm of Hitler, Tojo and Co. has been properly attended to, are likely to have a radically new type of reinforcement built into them. Instead of the now standard cords of rayon or cotton, they will contain solid strands, or monofils, of nylon-type plastic—the kind of thing already familiar as toothbrush bristles, fishing-line leaders and tennis-racket strings.

Use of these oriented synthetic linear polyamide monofils, to give them their full technical title, has just been made the subject of U. S. patent 2,317,911 by Dr. George P. Hoff, research chemist for E. I. DuPont DeNemours and Company, to whom rights have been assigned.

Monofil strands have been found greatly superior to cotton and rayon cords, Dr. Hoff states, because of their great tensile strength, elasticity and flexibility, and because the absence of any twist makes for a better bonding between them and the rubber. He adds that the use of the new type of reinforcement will permit tires to be made much lighter and thinner—a long-yearned-for but unrealized dream of automobile engineers.

Headlights for Jeeps

Headlights for jeeps, peeps and other tough little military vehicles that have to "take it" are covered by patent 2,317,619, granted to C. F. Kramer of Birmingham, Mich., and assigned by him to the Ford Motor Company. Headlights on such cars have to be kept behind the brush-guard of slat-like steel bars, which makes them hard to get at for bulb changes and general repairs. Mr. Kramer's device is a simple, ruggedly built hinged bracket which enables the lamp to be lifted out from behind the bars when service is needed.

Improvements in Helicopters

Three patents on improvements in helicopters, numbers 2,317,340 to 2,317,342 inclusive, have been obtained by two British subjects, who have assigned rights in this country to the Autogiro Company of America. The first two were taken out by J. A. J. Bennett of Esher, England, and the third by Cyril G. Pullin of Genista, Scotland.

Both inventors have attacked the problem of the tendency of single-rotored helicopters to slew their bodies around, due to the torque of the rotor. Both offset this torque by using ordinary horizontal airplane propellers, powered from the same engine that runs the rotor. Mr. Pullin uses one such propeller, offset; the design of Mr. Bennett calls for two. The latter craft is also so constructed that the power can be cut off from the rotor if desired, converting it, in effect, from a helicopter to an autogiro while in the air.

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It is because of you and millions of women like you—cooperating with American merchants—that the cost of living has gone up only 7 per cent since your Government's price control started.

But the end is not yet. So keep up the good work. Ask *every time*, "Is this the ceiling price?" Never buy a single thing that you can do without. Save your money—in the bank, in life insurance, in War Bonds. When you use things up, wear 'em out, make 'em do, or do without . . . you're helping to HOLD PRICES DOWN!

YOUR STORE WILL BE GLAD TO HAVE YOU ASK:

"Is this the ceiling price?"

A United States War Message prepared by the War Advertising Council; approved by the Office of War Information; and contributed by this magazine in cooperation with the Magazine Publishers of America.